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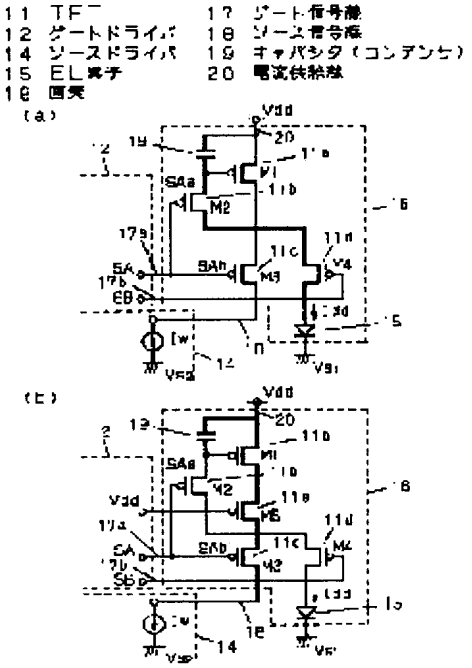
(54) DISPLAY SUBSTRATE, AND METHOD AND DEVICE FOR ITS INSPECTION

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method and a device for inspecting a display panel such as EL.
SOLUTION: A Vdd voltage is applied to the source terminal of a driving TFT 11a and a VS1 voltage is applied to the cathode terminal of an EL element 15. ON voltage applied to gate signal lines 17a and 17b makes TFTs 11b, 11c, and 11d turn on, and a source signal line 18 enters an open state. A current Iw does not flow and all the current flowing to the driving TFT 11a becomes a current Idd flowing to the EL element 15. Pixels displayed on the display panel, therefore, all illuminate. If there is a pixel which does not illuminate, breakage of a TFT or low capacity is estimated.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]An array substrate comprising:
The 1st shorting part that is in an array substrate used for an EL display which performs light modulation by having two or more gate signal lines per pixel, and at least one source signal line, and controlling said signal wire, and short-circuits electrically a source signal line of two or more of said pixels.
The 2nd shorting part that short-circuits electrically a gate signal line of two or more of said pixels.
A terminal area which electrically connects said 1st shorting part and the 2nd shorting part.

[Claim 2]An array substrate comprising:
The 1st shorting part that is shown in an EL display which performs light modulation by having the 1st gate signal line, the 2nd gate signal line, and at least one source signal line per pixel, and controlling said signal wire, and short-circuits electrically a source signal line of two or more of said pixels.
The 2nd shorting part that short-circuits electrically the 1st gate signal line of two or more of said pixels.
The 3rd shorting part that short-circuits electrically the 2nd gate signal line of two or more of said pixels.
The 1st terminal area which electrically connects said 1st shorting part and the 2nd shorting part, and the 2nd terminal area which electrically connects said 2nd shorting part and the 3rd shorting part.

[Claim 3]Test equipment comprising:
A switching element is arranged at each pixel, and a pixel is arranged at matrix form, A gate voltage apply means which is in test equipment used for an EL display which performs light modulation by having two or more gate signal lines per pixel, and at least one source signal line, and controlling said signal wire, and impresses voltage which makes said switching element an operating state to said two or more gate signal lines.
A cathode voltage applying means which impresses the 1st voltage to a cathode of said EL display.
An anode voltage applying means which impresses the 2nd voltage to an anode of said EL display.
An optical measurement means which detects or measures a lighted condition of said EL display optically.

[Claim 4]Test equipment comprising:
A switching element is arranged at each pixel, and a pixel is arranged at matrix form, It has two or more gate signal lines per pixel, and at least one source signal line, And a gate voltage apply means which is in test equipment used for an array which constitutes an EL display which performs light modulation by controlling said signal wire, and impresses voltage which makes said switching element an operating state to said two or more gate signal lines.
A cathode voltage applying means which impresses the 1st voltage to a cathode of said array.
An anode voltage applying means which impresses the 2nd voltage to an anode of said array.
An inspection means which detects or measures current outputted from a source signal line of said array.

[Claim 5]A switching element is arranged at each pixel, and a pixel is arranged at matrix form, It has two or more gate signal lines per pixel, and at least one source signal line, And a gate voltage apply means which is an inspection method used for an EL display which performs light modulation by controlling said signal wire, and impresses voltage which makes said switching element an operating state to said two or more gate signal lines, Voltage which makes said switching element an operating state is impressed to two or more gate signal lines of each pixel of said EL display, An inspection method of an EL display making a source signal line of each of said pixel into an open condition, impressing the 1st voltage to an anode of said EL display, and impressing the 2nd voltage lower than said 1st voltage to a cathode of said EL display.
[Claim 6]A drive transistor by which one pixel controls at least current sent through EL film, A capacitor holding gate potential of said drive transistor, and the 1st switching transistor that constitutes a course which sends through said drive transistor current outputted from a driver, It is the EL display panel which comprises the 2nd switching transistor that constitutes a course which sends current from said drive transistor through said EL film, Make said 1st switching transistor into an operating state, and said 2nd switching transistor is made into a non-operating state, An inspection method of an EL display panel making said 2nd switching transistor into an operating state with the 1st operation that charges said capacitor at prescribed voltage, and making said 2nd switching transistor into a non-operating state, and carrying out 2nd operation that sends current through said EL element.
[Claim 7]A drive transistor by which one pixel controls at least current sent through EL film, A capacitor holding gate potential of said drive transistor, and the 1st switching transistor that constitutes a course which sends through said drive transistor current outputted from a driver, It is the EL display panel which comprises the 2nd switching transistor that constitutes a course which sends current from said drive transistor through said EL film, Make said 1st switching transistor into an operating state, and said 2nd switching transistor is made into a non-operating state, Make said 2nd switching transistor into an operating state with the 1st operation that charges said capacitor at prescribed voltage, and said 2nd switching transistor is made into a non-operating state, An inspection method of an EL display panel changing a cycle which carries out 2nd operation that sends

current to said EL element, and changes said 1st operation and said 2nd operation to it.
[Claim 8]A drive transistor by which one pixel controls at least current sent through EL film.
A capacitor holding gate potential of said drive transistor.
A gate driver circuit which comprises a switching transistor which charges said capacitor, and chooses said switching transistor.
A source signal line end which is an inspection method of an EL display panel provided with the above, and was connected to two or more pixels is made into an electric open condition, While operating said gate driver circuit, and making said switching transistor into an operating state and impressing the 1st voltage to an anode of said EL display panel, the 2nd voltage lower than said 1st voltage is impressed to a cathode of said EL display panel.

[Claim 9]An EL display panel which performs light modulation by arranging a switching element at each pixel characterized by comprising the following, and arranging a pixel at matrix form, and having the 1st and 2nd gate signal lines and source signal lines per pixel [at least], and controlling said signal wire.
The 1st gate voltage apply means that impresses voltage which makes a switching element an operating state to said two or more 1st gate signal lines.
The 2nd gate voltage apply means that impresses voltage which makes a switching element an operating state to said two or more 2nd gate signal lines.
An anode voltage applying means which impresses voltage to an anode of said EL display panel.
A cathode voltage applying means which impresses voltage to a cathode of said EL display.

[Claim 10]A switching element is arranged at each pixel characterized by comprising the following, And an EL display panel which performs light modulation by arranging a pixel at matrix form, and having the 1st gate signal line, 2nd gate signal line, 3rd gate signal line, and source signal line per pixel [at least], and controlling said signal wire.
The 1st gate voltage apply means that impresses voltage which makes a switching element an operating state to the 1st aforementioned gate signal line.
The 2nd gate voltage apply means that impresses voltage which makes a switching element an operating state to said two or more 2nd gate signal lines.
The 3rd gate voltage apply means that impresses voltage which makes a switching element an operating state to said two or more 3rd gate signal lines.
An anode voltage applying means which impresses voltage to an anode of said EL display panel, and a cathode voltage applying means which impresses voltage to a cathode of said EL display.

[Claim 11]A drive transistor by which one pixel controls at least current sent through EL film.
A capacitor holding gate potential of said drive transistor.
A gate driver circuit which comprises a switching transistor which charges said capacitor, and chooses said switching transistor.
A source driver circuit which outputs a video signal.
While being an inspection method of an EL display panel provided with the above, operating said gate driver circuit, and making said switching transistor into an operating state and impressing the 1st voltage to an anode of said EL display panel, The 2nd voltage lower than said 1st voltage is impressed to a cathode of said EL display panel, and an output of said source driver circuit is made into an open condition.

[Claim 12]An EL display panel comprising:
A drive transistor by which one pixel controls at least current sent through EL film.
A capacitor holding gate potential of said drive transistor.
A gate signal line which transmits a signal which comprises a switching transistor which charges said capacitor and chooses said switching transistor.
A source signal line which transmits a video signal impressed to said pixel, and a capacitor signal wire which transmits voltage which sets up potential of an end of said capacitor.

[Claim 13]An information display device comprising:
The EL display panel according to claim 12.
A down converter.
An up converter.
A receiver and a loudspeaker.

[Claim 14]The information display device according to claim 13 providing a touch panel in a viewing area.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]It is related with the EL display panel of this invention which displays a picture mainly with spontaneous light, the array substrates used for this, these test equipment, inspection methods, etc.
[0002]
[Description of the Prior Art]Since many liquid crystal display panels to a portable equipment etc. are adopted from the advantage of low power consumption with a thin shape, they are used for apparatus, such as a word processor, a personal computer, television (TV), the viewfinder of a video camera, a monitor, etc.
[0003]
[Problem(s) to be Solved by the Invention]However, since liquid crystal display panels are not spontaneous optical devices, there is a problem that it cannot be displayed that a picture does not use a back light. Since predetermined thickness was required in order to constitute a back light, there was a problem that the thickness of a display module became thick.
[0004]In order for a liquid crystal display panel to perform a colored presentation, it is necessary to use a light filter. Therefore, there was a problem that efficiency for light utilization was low.
[0005]
[Means for Solving the Problem]A thing which is characterized by comprising the following in order that this invention may solve the above-mentioned problem and which provides an array substrate.
The 1st shorting part that is in an array substrate used for an EL display which performs light modulation by having two or more gate signal lines per pixel, and at least one source signal line, and controlling said signal wire, and short-circuits electrically a source signal line of two or more of said pixels.
The 2nd shorting part that short-circuits electrically a gate signal line of two or more of said pixels.
A terminal area which electrically connects said 1st shorting part and the 2nd shorting part.

[0006]It has the 1st gate signal line, the 2nd gate signal line, and at least one source signal line per pixel, And the 1st shorting part that is shown in an EL display which performs light modulation by controlling said signal wire, and short-circuits electrically a source signal line of two or more of said pixels, The 2nd shorting part that short-circuits electrically the 1st gate signal line of two or more of said pixels, The 3rd shorting part that short-circuits electrically the 2nd gate signal line of two or more of said pixels, An array substrate having the 1st terminal area which electrically connects said 1st shorting part and the 2nd shorting part, and the 2nd terminal area which electrically connects said 2nd shorting part and the 3rd shorting part is provided.
[0007]A switching element is arranged at each pixel, and a pixel is arranged at matrix form, It has two or more gate signal lines per pixel, and at least one source signal line, And a gate voltage apply means which is in test equipment used for an EL display which performs light modulation by controlling said signal wire, and impresses voltage which makes said switching element an operating state to said two or more gate signal lines, A cathode voltage applying means which impresses the 1st voltage to a cathode of said EL display, Test equipment possessing an anode voltage applying means which impresses the 2nd voltage to an anode of said EL display, and an optical measurement means which detects or measures a lighted condition of said EL display optically is provided, and there is also **.
[0008]
[Embodiment of the Invention]In order that each drawing may draw an understanding easily in this specification, there are an abbreviation and a part which carried out scaling. For example, with the sectional view of the display panel of drawing 7, the sealing film 73 etc. are illustrated thickly enough. In drawing 1, thin film transistors (TFT) which impress a signal to a picture element electrode are omitted.
[0009]It is desirable to omit the phase films for phase compensation etc., etc. and for ** to add timely in the display panel of this invention. The above thing is the same also to the following drawings. The part which attached the same number or the sign has a same or similar gestalt, material, a function, or operation.
[0010]Especially the contents explained with each drawing are combinable with other examples, even if there is no notice. For example, a touch panel etc. can be added to the display panel of drawing 1 or drawing 35, and drawing 39, and it can be considered as an information display device. A magnifying lens can be attached and viewfinders, such as a video camera, can also be constituted.
[0011]It cannot be overemphasized that the test equipment of drawing 25 is applicable not only to drawing 24 but drawing 28, drawing 29, etc. It cannot be overemphasized that the analog switch 334 of the source driver 14 explained by drawing 33 may not be formed in a source driver, but it may form in the end of the source signal line 18 of the array substrate 49 using low-temperature polysilicon art etc.
[0012]The matter about inverter 23 number of stages of the source driver of drawing 33, etc. can apply the matter explained by drawing 2. It cannot be overemphasized that it cannot be limited to this although this invention mainly explains the active-matrix type display panel in which TFT was formed in each pixel, and it can apply also to a simple matrix type.
[0013]Thus, even if not illustrated in particular in the specification, the matter, contents, and specification which were indicated

or explained in the specification and the drawing can be combined mutually, and can be indicated to a claim. It is because it is impossible to describe all the combination on specifications etc.
[0014]The organic electroluminescence display panel which is low power consumption, is high indication quality, and also is constituted by arranging the plurality of an organic electroluminescence (EL) element to matrix form as a display panel which can be slimmed down attracts attention. An organic electroluminescence display panel or an organic EL device may be called OELD or OLED.
[0015]As an organic electroluminescence display panel is shown in drawing 4, the organic stratum functionale (EL layer) 47 of at least one layer which consists of an electron transport layer, a luminous layer, an electron hole transporting bed, etc. on the glass plate 49 (array substrate) with which the transparent electrode 48 as a picture element electrode was formed, and the metal electrode (reflection film) 46 are laminated.
[0016]The organic stratum functionale (EL layer) 47 emits light by applying the voltage of plus and the minus to the negative pole (cathode) of the metal electrode (reflector) 46 to the anode (anode) of the transparent electrode (picture element electrode) 48, namely, impressing a direct current between the transparent electrode 48 and the metal electrode 46. By using the organic compound which can expect a good luminescent characteristic for the organic stratum functionale, an EL display panel can be equal to practical use.
[0017]A cathode terminal or a reflection film may form and constitute the optical interference film which becomes an ITO electrode from a dielectric multilayer. A dielectric multilayer forms the dielectric film of a low refractive index, and the dielectric film of a high refractive index in a multilayer by turns. That is, it is a dielectric mirror. This dielectric multilayer has a function which makes good the color tone of the light emitted from organic electroluminescence structure (screen effect).
[0018]It is preferred to use for the metal electrode 46 what has small work functions, such as aluminum, magnesium, indium, copper, or each alloy. It is preferred to use an aluminum-Li alloy especially, for example. A big conductive material or gold of a work function, such as ITO, etc. can be used for the transparent electrode 48. When gold is used as an electrode material, an electrode will be in a translucent state.
[0019]When vapor-depositing a thin film to the picture element electrode 46 etc., it is good to form an organic electroluminescence film in argon atmosphere. On ITO as the picture element electrode 46, by forming 2 or more nm [10] or less, the stability of an interface improves and light emitting luminance and luminous efficiency will also become good about carbon.
[0020]Hereafter, in order to make easy an understanding of the EL display panel structure of this invention, the manufacturing method of the organic electroluminescence display panel of this invention is explained first.
[0021]In order to improve heat dissipation nature of the substrate 49, it may form with sapphire glass. A thermally conductive good thin film or thick film may be formed. For example, using the substrate in which diamond membrane was formed is illustrated. Of course, a quartz glass substrate, a soda glass substrate, or a glass-of-lead board may be used.
[0022]In addition, that which used ceramic substrates, such as alumina, or used the metal plate which consists of silicon or copper or by which vacuum evaporation or spreading coated the insulator layer with the metal membrane may be used.
[0023]When using a picture element electrode as a reflection type, since light is emitted from the direction of the surface of a substrate as a substrate material, in addition to the transparence thru/or translucent material of glass, quartz, resin, etc., impermeable material, such as stainless steel, can also be used. This composition is illustrated to drawing 7. The cathode terminal is formed with the transparent electrodes 72, such as ITO.
[0024]It cannot be overemphasized that a substrate may use a plastic plate. It can be hard to break a plastic plate, and since it is lightweight, it is the optimal as a substrate for display panels of a cellular phone. As for a plastic plate, it is preferred to paste an auxiliary substrate together to one field of the base board used as a core material with adhesives, and to use as a laminated circuit board. Of course, these substrate 321 grades may not be limited to a board, and a with a 0.3 mm or less 0.05 mm or more thickness film may be sufficient as them.
[0025]Degradation of organic electroluminescence by moisture is early. Since perviousness of resin is good, it is preferred to form a DLC (diamond- -like carbon) film in a substrate face for the purpose of preventing this. moreover -- many -- when several films or substrates are stretched and it constitutes them, it constitutes -- many -- it is preferred to use the thing in which the DLC film was formed on the one or more surfaces, such as a film of several sheets. A thin glass substrate may be used, or the interlayer of the substrate which constitutes a metallic film or a board may be made one or more substrates, and may be employed as them. What vapor-deposited mineral matter, such as SiO2, SiNx, aluminum2O3, etc. besides DLC, may be used. What vapor-deposited or applied the inorganic thin film to the multilayer for the metal thin film may be used as an interlayer, or it may form on the surface of a substrate.
[0026]As a substrate of a base board, it is preferred to use alicyclic polyolefin resin. A single board with a thickness of 200 micrometers of ARTON by Japan Synthetic Rubber Co., Ltd. is illustrated as such alicyclic polyolefin resin. The hard court layer which has heat resistance, solvent resistance, or a moisture permeability-proof function in one field of a base board, And the substrate (or a film or a film) of the assistance which consists of polyester resin, polyethylene resin, or polyether sulfone resin etc. in which the gas barrier layer with an infiltrative-proof function was formed is arranged.
[0027]The thin film transistor (TFT) as two or more switching elements or current control elements is formed in 1 pixel. TFT to form may be the same kind of TFT, and like TFT of P channel type and N channel type, although it may be TFT of a different kind, a switching transistor and the transistor for a drive of the thing of like-pole nature are desirably desirable. The structure of TFT is not limited by planer type TFT, and may also depend that in which a stagger type or a reverse stagger type may be used, and the impurity range (sauce, drain) was formed using the self aryne method on a non-self aryne method.
[0028]EL display device of this invention has EL structure by which ITO and one or more sorts of organic layers which serve as a hole injection electrode (picture element electrode) on a substrate, and an electron injection electrode were laminated one by one. TFT is provided in said substrate.
[0029]In order to manufacture EL display device of this invention, the array of TFT is first formed on a substrate at desired shape. And ITO which is a transparent electrode as a picture element electrode on a flattening film is formed and patterned by a sputtering technique. Then, an organic electroluminescence layer, an electron injection electrode, etc. are laminated.
[0030]What is necessary is just to use the usual polycrystalline silicon TFT as TFT. TFT is provided in the end of each pixel of

EL structure, and the size is about 10-30 micrometers. The sizes of a pixel are 20 micrometers x 20 micrometers - 300 micrometers x about 300 micrometers.
[0031]The wiring electrode of TFT is provided on a substrate. Although there is a function for the resistance of a wiring electrode to be low, it to electrically connect a hole injection electrode, and to hold down resistance low and that in which the wiring electrode contains any one sort of aluminum, aluminum and a transition metal (however, except for Ti), Ti, or the titanium nitride (TiN) or two sorts or more is generally used, In this invention, it is not restricted to this material. What is necessary is just to be usually about 100-1000 nm as thickness of the whole which combined the hole injection electrode used as the ground of EL structure, and the wiring electrode of TFT, although there is no restriction in particular.
[0032]An insulating layer is provided between the wiring electrode of TFT, and the organic layer of EL structure. That in which the insulating layer formed inorganic system materials, such as silicon oxide of SiO2 grade, and silicon nitride, with weld slag or vacuum deposition, As long as the coat etc. of resin system materials, such as a silicon oxide layer formed by SOG (spin one glass), photoresist, polyimide, and an acrylic resin, have insulation, they may be any, but polyimide's are preferred. An insulating layer also plays the role of the anticorrosion and the waterproof film which protects a wiring electrode from moisture or corrosion.
[0033]The light emission peak of EL structure may be two or more. As for EL display device of this invention, green and a blue light part are obtained with the combination of EL structure of blue-green luminescence, and a green transmission layer or a blue transmission layer, for example. A red light part can be obtained by the fluorescence conversion layer which changes bluish green luminescence of EL structure of blue-green luminescence, and this EL structure into the wavelength near red.
[0034]Next, EL structure which constitutes EL display device of this invention is explained. EL structure of this invention is provided with the following.
The electron injection electrode which is a transparent electrode.
One or more sorts of organic layers.
Hole injection electrode.
An organic layer has a hole transporting bed of at least one layer, and a luminous layer, respectively, for example, has an electron injection transporting bed, a luminous layer, an electron hole transporting bed, and a hole injection layer one by one. There may not be any hole transporting bed.
[0035]The organic layer of EL structure of this invention can be considered as various composition, it may omit electron injection and a transporting bed, may make it a luminous layer and one, or may mix a hole-injection transporting bed and a luminous layer. An electron injection electrode comprises the small metal, compound, or alloys of the work function preferably formed with vacuum deposition, such as vacuum evaporation and a sputtering technique.
[0036]Since it is the structure which takes out the light which emitted light from the hole injection electrode side as a hole injection electrode, ITO (tin dope indium oxide), IZO (zinc dope indium oxide), ZnO, SnO2, and In2O3 grade is mentioned, for example, but especially ITOIZO is preferred. The thickness of a hole injection electrode should just have the thickness more than [which can perform hole pouring enough] fixed, and it is usually preferred to be referred to as about 10-500 nm.
[0037]In order to raise the reliability of an element, it is required for driver voltage to be low, but ITO of 10-30ohms / ** (50-300 nm of thickness) is mentioned as a desirable thing. When actually using it, the cross protection by reflection by hole injection electrode interfaces, such as ITO, should just set up the thickness and the optical constant of an electrode fully satisfy optical extraction efficiency and color purity.
[0038]Although a hole injection electrode can be formed with vacuum deposition etc., forming by a sputtering technique is preferred. It does not restrict and what is necessary is just to use inactive gas, such as Ar, helium, Ne, Kr, and Xe, or these mixed gas especially as sputtering gas.
[0039]An electron injection electrode comprises the small metal, compound, or alloys of the work function preferably formed with vacuum deposition, such as vacuum evaporation and a sputtering technique. In order to raise metallic element simple substances, such as K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, aluminum, Ag, In, Sn, Zn, and Zr, or stability as a component of the electron injection electrode formed, it is preferred to use the alloy system of two ingredients and three ingredients containing them. As an alloy system, Ag-Mg (Ag:1 - 20at%), aluminum-Li (Li:0.3 - 14at%), In-Mg (Mg:50 - 80at%), aluminum-Ca (Ca:5 - 20at%), etc. are preferred, for example.
[0040]The thickness of an electron injection electrode thin film should just make electron injection the thickness more than [which can be performed enough] fixed, and should just set it to 1 nm or more preferably 0.1 nm or more. Although there is no restriction in particular in the upper limit, the thickness is just usually about 100-500 nm.
[0041]A hole injection layer has a function which makes easy pouring of the electron hole from a hole injection electrode, and an electron hole transporting bed has a function which bars the function and electron which convey an electron hole, and is also called an electric charge pouring layer and a charge transport layer.
[0042]An electron injection transporting bed is provided when the electron injection transportation function of the compound used for a luminous layer is not so high, and it has a function which bars the function which makes easy pouring of the electron from an electron injection electrode, the function to convey an electron, and an electron hole. A hole injection layer, an electron hole transporting bed, and an electron injection transporting bed increase - Make the electron hole and electron which are poured in to a luminous layer shut up, make a recombination area optimize, and improve luminous efficiency. An electron injection transporting bed may be separately provided in a layer with a pouring function, and a layer with a transportation function.
[0043]Although the thickness of a luminous layer, the thickness which combined the hole injection layer and the electron hole transporting bed, and the thickness in particular of an electron injection transporting bed are not limited but it changes also with formation methods, it is usually preferred to be referred to as about 5-100 nm.
[0044]What is necessary is just to make them into comparable as the thickness of a luminous layer or 1 / about 10 to 10 times, although the thickness of a hole injection layer and an electron hole transporting bed and the thickness of an electron injection transporting bed are based on the design of a recombination-radiation field. As for the thickness of a hole injection layer and an electron hole transporting bed, and each thickness in the case of dividing an electronic injection layer and an electron transport layer, it is [a pouring layer / 1 nm or more and a transporting bed] preferred to be referred to as not less than 20 nm. The

maximum of the thickness of the pouring layer at this time and a transporting bed is [in a pouring layer] usually about 100 nm at about 100 nm and a transporting bed. It is also the same as when providing two layers of pouring transporting beds about such thickness.

[0045]By what thickness is controlled for taking into consideration the carrier mobility and carrier density (decided by ionization potential and electron affinity) of the luminous layer and electron injection transporting bed to combine, or a hole-injection transporting bed. It is possible to design a recombination area and a luminous region freely, and design of the luminescent color, control of the light emitting luminance and the emission spectrum by the cross protection of two electrodes, and control of the spatial distribution of luminescence are enabled.

[0046]The luminous layer of the EL element of this invention is made to contain the fluorescence substance which is a compound which has a luminescence function. Tris(8-quinolinolato) aluminum which is indicated by JP,63-264692,A etc. as this fluorescence substance, for example [Alq3] A blue-green luminescent material which is indicated by the metal complex coloring matter of **, JP,6-110569,A (phenyl anthracene derivative), a 6-114456 gazette (tetra aryl ethene derivative), JP,6-100857,A, the JP,2-247278,A, etc. is mentioned.

[0047]To a hole injection layer and an electron hole transporting bed, for example JP,63-295695,A, JP,2-191694,A, JP,3-792,A, JP,5-234681,A, The various organic compounds indicated in JP,5-239455,A, JP,5-299174,A, JP,7-126225,A, JP,7-126226,A, JP,8-100172,A, and EP0650955A1 grade can be used. It is preferred to use a vacuum deposition method for formation of a hole-injection transporting bed, a luminous layer, and an electron injection transporting bed, since a homogeneous thin film can be formed. Hereafter, it explains in more detail about the manufacturing method and structure of an EL display panel of this invention. As explained above, TFT11 which drives a pixel to the array substrate 49 is formed first. One pixel comprises four pieces or five TFT(s). Current programming of the pixel is carried out and the programmed current is supplied to an EL element. Pixel configurations, such as combination of this TFT11, are explained later. Next, the picture element electrode as a hole injection electrode is formed in TFT11. The picture element electrode 48 is patternized by photo lithography.

[0048]Two or more picture element electrodes may be formed in 1 pixel, and an area gradation display may be realized by controlling these individually. It is also effective by changing the size of each picture element electrode of R, G, and B to make a white balance good.

[0049]After the substrate treatment after photolitho exfoliates by being immersed in commercial resist removing liquid (mixed solution of dimethyl sulfoxide and n methyl 2 pyrrolidone), it is rinsed with acetone, is further immersed for 1 minute into fuming nitric acid, and removes resist thoroughly. Washing on the surface of ITO which is the picture element electrode 48 is good to perform mechanical grinding washing with a nylon brush, fully performing both sides on the surface of a rear face of a substrate, and fully supplying the 0.238% solution of tetramethylammonium hydroxide. Then, it fully rinses with pure water and spin drying is performed.

[0050]Before vacuum evaporation of an organic thin film EL element, in a commercial plasma reactor (the Yamato Scientific Co., Ltd. make, PR41 type), after performing oxygen plasma treatment for 1 minute on condition of oxygen flow rate 20sccm, pressure 0.2Torr, and the high frequency output 300W, it is good to arrange in EL vacuum evaporation tub.

[0051]However, if oxygen plasma and O2 Usher are used at the time of washing, ashing also of the flattening film 71 of the periphery of the picture element electrode 48 will be carried out simultaneously, and the periphery of the picture element electrode 48 will be scooped out. In order to solve this technical problem, in this invention, the edge protective film 81 which consists picture element electrode 48 periphery of acrylic resins as drawing 8 shows is formed. As a component of the edge protective film 81, the organic materials and the identical materials which constitute the flattening film 71, such as acrylic resin and polyimide resin, are illustrated, in addition inorganic materials, such as SiO2 and SiNx, are illustrated. In addition, it cannot be overemphasized that it may be aluminum2O3 etc.

[0052]The edge protective film 81 is formed so that after the patterning 48 of the picture element electrode 48 and between the picture element electrode 48 may be filled. Of course, it cannot be overemphasized that it is good also as a bank (spacer keep a metal mask from touching the picture element electrode 48 directly) of the metal mask at the time of forming this edge protective film 81 in or more 2 a height of 4 micrometers or less, and distinguishing organic electroluminescence material by different color with.

[0053]With a natural thing, etching etc. may remove this edge protective film 81 after washing. It is good also as the edge protective film 81 to blow up a dopant material with heating.

[0054]A vacuum evaporator uses the device which converted the commercial high vacuum evaporation apparatus (the Japan vacuum-technology incorporated company make, EBV-6DA type). the main exhaust is a turbo-molecular pump (Makoto Osaka fictitious stock type company make, TC1500) of 1500 l. of exhaust speeds / min -- a ultimate vacuum -- about 1 -- it is less than x10e-6Torr, and all the vacuum evaporation is performed in the range of 2 - 3x10e-6Torr. All the vacuum evaporation is good to carry out by connecting DC power supply (Kikusui electronic incorporated company make, PAK10-70A) to the resistance heating type deposition boat made from tungsten.

[0055]Thus, on the array substrate arranged in a vacuum layer, a carbon film is formed to 2 or more nm [10] or less. Next, a 4-(N,N-bis(p-methylphenyl)amino)-alpha-phenylstilbene is formed in about 5 nm of thickness with the evaporation rate of 0.3 nm/s as a hole injection layer.

[0056]As an electron hole transporting bed, N,N'-bis(4'-diphenylamino 4-biphenylyl)-N,N'-diphenylbenzidine (made by Hodogaya chemicals incorporated company), Vapor codeposition of the 4-N,N-diphenylamino alpha-phenylstilbene was carried out with the evaporation rate of 0.3 nm/s and 0.01 nm/s, respectively, and it was formed in about 80 nm of thickness. tris(8-quinolinolato) aluminum (said -- Renhua -- study incorporated company make) is formed in about 40 nm of thickness with the evaporation rate of 0.3 nm/s as a luminous layer (electron transport layer).

[0057]next -- as an electron injection electrode -- an AlLi alloy (high grade chemicals incorporated company make.) Only Li is formed in about 1 nm of thickness with the evaporation rate of about 0.1 nm/s at low temperature from the aluminum/Li weight ratios 99/1, Then, temperature up of the AlLi alloy was carried out further, and from the state in which Li was all out, only aluminum was formed in about 100 nm of thickness with the evaporation rate of about 1.5 nm/s, and was used as the electron injection electrode of a lamination type.

[0058]Thus, the created organic thin film EL element, After leaking the inside of a vacuum evaporation tub with dry nitrogen,

under a dry nitrogen atmosphere, the Corning 7059 glass closure lid 41 was stuck with the seal adhesives (sealing compound) 45 (the Anelva CORP. make, trade name super back seal 953-7000), and it was considered as the display panel.
[0059]The drier 55 is arranged in the space of the closure lid 41 and the array substrate 49. It is because an organic electroluminescence film is weak to humidity as for this. The moisture which permeates the sealing compound 45 with the drier 55 is absorbed, and degradation of the organic electroluminescence film 47 is prevented.
[0060]In the luminous layer which doped the guest to the host, it becomes possible about improvement in luminosity and color purity by inhibiting the intermolecular interaction of guest molecules paying attention to the nano-scale state of aggregation of a guest material.
[0061]When the guest material which bears the role which emits light in organic electroluminescence determines luminescent ability, it plays the most important role. Although a luminescent characteristic high in a solution is shown on the occasion of development of a red guest material, there is a problem that efficiency falls into a film. Its attention is paid to the state of aggregation of the guest material currently first distributed in a luminous layer in order to solve this problem. It is because the intermolecular interaction of the guest molecules which form a nano-scale state of aggregation has had big influence on the luminescent characteristic of organic electroluminescence.
[0062]An intermolecular interaction can be inhibited by investigating the structure of a guest molecule, and correlation of an intermolecular interaction, and feeding back to a molecular design. Therefore, it comes to acquire in a film the high luminescent characteristic in the solution states which a guest material has. It is good to use the host material possible nearest to a guest's luminous wavelength so that matching between a host and a guest may become the optimal.
[0063]In order to control osmosis of the moisture from the sealing compound 45, it is a good measure to lengthen the course (path) from the outside. For this reason, the detailed unevenness 43 and 44 is formed in the periphery of a viewing area in the display panel of this invention. The heights 44 formed in the periphery of the array substrate 49 are formed doubly at least. As for the interval (formed pitch) of a convex and a convex, it is preferred to form in not less than 100 micrometers 500 micrometers or less, and the height of a convex has preferred not less than 30-micrometer thing set to 300 micrometers or less. These heights are formed with the La Stampa art. This La Stampa art applies the method which OMRON Corp. has adopted as the method of micro-lens formation, and the method which Matsushita Electric uses as a formation method of a microlens with the pickup lens of CD.
[0064]On the other hand, the heights 43 are formed also in the closure lid 41. The formed pitch of the heights 43 is made the same as that of the formed pitch of the heights 44. Thus, the heights 44 fit into the heights 43 exactly by making the same a formed pitch with the heights 43 and 44. Therefore, the position gap with the closure lid 41 and the array substrate 49 does not occur at the time of manufacture of a display panel. The sealing compound 45 is arranged between the heights 43 and 44. The sealing compound 45 prevents permeation of the moisture from the outside while pasting up the closure lid 41 and the array substrate 49.
[0065]It is preferred to use what consists of acrylic resin with UV (ultraviolet rays) hardening type as the sealing compound 45. As for an acrylic resin, it is preferred to use what has a fluorine group. In addition, the adhesives or the binder of an epoxy system may be used.
[0066]As for the refractive index of adhesives or a binder, it is preferred to use or more 1.47 1.54 or less thing. As for especially seal adhesives, it is preferred to add impalpable powder, such as impalpable powder of titanium oxide and silicon oxide, at a rate of 95% or less not less than 65% by a weight ratio. As for the particle diameter of this impalpable powder, it is preferred that an average diameter carries out not less than 20 micrometers 100 micrometers or less. The effect which controls penetration of the humidity from the forge-fire outside where the weight ratio of impalpable powder increases becomes high. However, if too large, air bubbles etc. will enter easily, space will become large on the contrary, and a sealing effect will fall.
[0067]As for the weight of a drier, it is preferred to carry out 0.04g or more per 10 mm in length of seal 0.2g or less. It is desirable to carry out 0.06g or more per 10 mm in length of seal 0.15g or less especially. the quantity of a drier becomes empty -- shortly after there is too nothing, there are few moisture preventive effects and an organic electroluminescence layer deteriorates. If too large, when a drier will carry out a seal, it becomes an obstacle, and a good seal cannot be performed.
[0068]Although it is the composition closed using the lid 41 of glass in drawing 4, it may be closure using a film like drawing 7. For example, using for the film of an electrolytic condenser what vapor-deposited DLC (diamond- -like carbon) as a sealing film is illustrated. This film has very bad moisture perviousness (moisture proof). This film is carried out sealing film 74, and it uses. It cannot be overemphasized that the composition thing which vapor-deposits a DLC film directly on the surface of the electrode 72 is good.
[0069]It is reflected with the reflection film 46, and the half of the light generated from the organic electroluminescence layer 47 is penetrated with the array substrate 49, and is emitted. However, outdoor daylight is reflected, a reflect lump occurs and the reflection film 46 reduces display contrast. For this measure, the lambda/4 board 50 and the polarizing plate 54 are arranged to the array substrate 49. When a pixel is a reflector, the light generated from EL layer 47 is emitted upward. Therefore, it cannot be overemphasized that the phase plate 50 and the polarizing plate 54 are arranged to the optical outgoing radiation side.
[0070]A reflection type pixel is obtained by constituting the picture element electrode 48 from aluminum, chromium, silver, etc. An interface with an organic electroluminescence layer becomes large by providing heights (or uneven part) in the surface of the picture element electrode 48, and an emission area becomes large, and luminous efficiency improves.
[0071]Between the substrate 49 and the polarizing plate (polarization film) 54, one sheet or two or more phase films (a phase plate, a phase rotating means, a phase difference plate, a phase difference film) are arranged. It is preferred to use polycarbonate as a phase film. A phase film makes emitted light generate phase contrast for incident light, and contributes to performing light modulation efficiently.
[0072]In addition, an organic resin board or organic resin films, such as polyester resin, PVA resin, polysulphone resin, vinylchloride resin, ZEONEX resin, an acrylic resin, and polystyrene resin, etc. may be used as a phase film. In addition, the crystal of crystal etc. may be used. The phase contrast of one phase plate has preferred not less than 50-nm thing set to 350 nm or less to 1 shaft orientations, and not less than 80 more nm the thing set to 220 nm or less is preferred.
[0073]It cannot be overemphasized that the circular light board 74 (circular light film) which unified the phase film and the polarizing plate so that it might illustrate to drawing 7 may be used.

[0074]As for the phase film 50, it is preferred for a color or paints to color and to give the function as a filter. The red (R) purity of especially organic electroluminescence is bad. Therefore, the fixed wavelength range is omitted with the colored phase film 50, and a color temperature is adjusted. As for a light filter, it is common to be provided by pigment dispersion type resin as a dyeing filter. Paints absorb the light of a specific wavelength band region, and penetrate the light of the wavelength band region which was not absorbed. It may be with the light filter of mosaic shape itself as a phase film. In this case, EL element 15 uses the thing of white light.
[0075]A part or the whole of a phase film may be colored as mentioned above, or a diffusing function may be given to the whole in part. Embossing of the surface may be carried out or an antireflection film may be formed for acid resisting. It is preferred to form a light-shielding film or a light absorption film in a part without the part or trouble which is not effective in image display, and to tighten the black level of a display image, or to demonstrate the contrast improvement effect by antihalation.
[0076]A micro lens may be formed in the shape of boiled fish paste, or matrix form by forming unevenness in the surface of a phase film. A micro lens is arranged so that it may correspond to one picture element electrode or a trichromatic pixel, respectively.
[0077]Detailed ** prism etc. are contained in the definition of a micro lens besides a lens with condensing nature. In addition, what has needlelike shape is contained. That is, one shape corresponds in accordance with [abbreviated] pixel size, or a micro lens is as follows [pixel size], and all the things that make light crooked are contained.
[0078]Although described also in advance, the function of a phase film may be given to a light filter. For example, phase contrast can be generated, when rolling at the time of formation of a light filter or making it phase contrast arise in the fixed direction by photopolymerization. In addition, phase contrast may be given by carrying out photopolymerization of the smoothing film 71 of drawing 7. If constituted in this way, it becomes unnecessary not to constitute a phase film or to arrange it out of a substrate, the composition of a display panel becomes simple, and low cost-ization can be desired. It cannot be overemphasized that the above matter may be applied to a polarizing plate.
[0079]As a main material which constitutes the polarizing plate (polarization film) 54, a TAC film (triacetyl cellulose film) is the optimal. A TAC film is because it has the outstanding optical property, surface smoothness, and processing suitability. About manufacture of a TAC film, it is optimal to produce with solution flow casting film production art.
[0080]The thing of the resin film in which the polarizing plate added iodine etc. to poly vinyl alcohol (PVA) resin is illustrated. Since the polarizing plate of the polarization separating means of a couple performs polarized light separation by absorbing the polarization component of the specific direction of a polarization axis, and a different direction among incident light, its utilization efficiency of light is comparatively bad. Then, the reflecting polarizer which performs polarized light separation may be used by reflecting the polarization component (reflective polarizer: reflective polarizer) of the specific direction of a polarization axis, and a different direction among incident light. If constituted in this way, the utilization efficiency of light will increase with a reflecting polarizer, and a display brighter than the above-mentioned example using a polarizing plate will be attained.
[0081]Besides such a polarizing plate or a reflecting polarizer, as a polarization separating means of this invention, For example, it is also possible to use what combined the cholesteric liquid crystal layer and lambda (1/4) board, the thing divided into reflective polarization and transmitted polarized light using Brewster's angle, the thing using a hologram, a polarization beam splitter (PBS), etc.
[0082]The AIR coat is given to the surface of the polarizing plate 54 although not illustrated in drawing 4. The composition which forms an AIR coat with dielectric monolayer or a multilayer film is illustrated. In addition, resin of the low refractive index of 1.35-1.45 may be applied. For example, the acrylic resin of a fluorine system, etc. are illustrated. Especially the characteristic has [a refractive index] good or more 1.37 1.42 or less thing.
[0083]An AIR coat has the composition of three layers, or two-layer composition. In the case of three layers, it is used in order to prevent reflection in the wavelength band region of large visible light, and it calls this a multi-coat. In a two-layer case, it is used in order to prevent reflection in the wavelength band region of specific visible light, and it calls this V coat. A multi-coat and V coat are properly used according to the use of a display panel. Not the thing to limit more than two-layer but one layer may be sufficient.
[0084]In the case of a multi-coat, optical thickness laminates nd1=lambda/2, and magnesium fluoride (MgF2) nd1=lambda/4, and forms an aluminum oxide (aluminum2O3) for nd=lambda/4, and a zirconium (ZrO2). Usually, a thin film is formed as a value of 520 nm or the neighborhood of those as lambda. In the case of V coat, nd1=lambda/4 or yttrium oxide (Y2O3), and magnesium fluoride (MgF2) are laminated n d1=lambda/4, and it forms silicon monoxide (SiO) for optical thickness nd1=lambda/4, and magnesium fluoride (MgF2). It is better to use Y2O3, when modulating blue glow, since SiO has an absorption band region in the blue side. Since the direction of Y2O3 is stable also from the stability of a substance, it is desirable. SiO2 thin film may be used. Of course, it is good also as an AIR coat using resin of a low refractive index, etc. For example, acrylic resins, such as fluoride, are illustrated. As for these, it is preferred to use an ultraviolet curing type.
[0085]In order to prevent static electricity from being charged by the display panel, it is preferred to apply resin of hydrophilic nature to the surfaces, such as a display panel. In addition, in order to prevent surface reflection, embossing may be performed on the surface of the polarizing plate 54, etc. It is also effective to form transparent electric conduction things, such as ITO, for the surface.
[0086]Although TFT is connected to the picture element electrode 48, it is not limited to this. It cannot be overemphasized that a diode method (TFD), a barista, a thyristor, ring-die oared, a PLZT element, etc. besides a thin film transistor (TFT) may be sufficient as an active matrix as a switching element. In addition, plasma addressing art may be used. As for TFT, it is preferred to adopt LDD (low doping drain) structure.
[0087]All the general element which carry out transistor operation of switching, such as FET, etc. is meant in TFT. It cannot be overemphasized that the composition of EL film, panel structure, etc. are applicable also to a simple matrix type display panel. It cannot be overemphasized that it does not limit to this although an example raises an organic EL device with this specification and it explains it as an EL element, and it is applied also to an inorganic EL element.
[0088]The active matrix system used for an organic EL panel should choose the pixel of 1. specification, and gives required display information. Two conditions that current can be sent through an EL element through 2 and 1 frame period must be satisfied.

[0089]In order to satisfy these two conditions, in the element composition of the conventional organic electroluminescence shown in drawing 12, the transistor for switching for 1st TFT11a to choose a pixel and 2nd TFT11b are taken as the transistor for a drive for supplying current to EL15.
[0090]Although the transistor 11a for switching is required for liquid crystals as compared with the active matrix system used for a liquid crystal here, the transistor 11b for a drive is required in order to make EL15 turn on. Although this reason can hold an ON state by impressing voltage in the case of a liquid crystal, it is because the lighted condition of the pixel 16 cannot be maintained if it does not continue sending current when it is EL15.
[0091]Therefore, in order to continue sending current, making the transistor 11b one [an EL panel] must be continued. First, if both a scanning line and the data line are turned on, an electric charge will be accumulated in the capacitor 19 through the transistor 11a for switching. The one [current continues flowing from the current supply source line 20, and / the pixel 16] over 1 frame period in order that this capacitor 19 may continue applying voltage to the gate of the transistor 11b for a drive, even if the transistor 11a for switching is come by off.
[0092]When displaying gradation using this composition, it is necessary to impress the voltage according to gradation as gate voltage of the transistor 11b for a drive. Therefore, dispersion in the ON state current of the transistor 11b for a drive appears in a display as it is.
[0093]If the ON state current of a transistor is the transistor formed with the single crystal, it is very uniform, but. In low-temperature polycrystal galvanized iron JISUTA which the forming temperature which can be formed in a cheap glass substrate formed with the low-temperature polysilicon art of 450 degrees or less. Since dispersion in the threshold has dispersion in the range which is **0.2V-0.5V, the ON state current which flows through the transistor 11b for a drive varies corresponding to this, and nonuniformity occurs in a display. Such nonuniformity generates not only dispersion in threshold voltage but the mobility of TFT and the thickness of gate dielectric film.
[0094]Therefore, in order to obtain a uniform display, it is necessary to control the characteristic of a device by the method of displaying gradation in analog, strictly, and cannot be satisfied with it of the spec. which is less than a prescribed range about this variation of stopping, in the present low-temperature polycrystal poly-Si TFT. Since this problem is solved, four transistors are provided in 1 pixel and how to make dispersion in threshold voltage compensate by a capacitor, and to acquire uniform current, the method of forming a current regulator circuit for every pixel, and attaining equalization of current, etc. can be considered.
[0095]Since the current by which these methods are programmed is programmed through EL element 15, when a current route changes, the transistor which controls driving current to the switching transistor connected to a power source line serves as a source follower, and a drive margin becomes narrow. Therefore, it has the technical problem that driver voltage becomes high.
[0096]It is necessary to use the switching transistor linked to a power supply in the field where impedance is low, and the technical problem that it is influenced by the characteristic fluctuation of EL element 15 also has this working range. moreover, when kink current occurs in the volt ampere characteristic in a saturation region and change of the threshold voltage of a transistor occurs in it, if the memorized current value is changed to it, it will obtain to it, and a technical problem is also in it.
[0097]Even if the transistor which controls the current which flows into EL element 15 does not serve as source follower composition to an aforementioned problem and the EL element structure of this invention has kink current in the transistor, It is the composition which can make small change of the current value which can suppress the influence of kink current to the minimum, and is memorized.
[0098]The EL element structure of this invention is specifically formed of two or more transistors 11 and EL elements which a unit pixel becomes from at least four as shown in drawing 1 (a). A picture element electrode is constituted so that it may lap with a source signal line. That is, the flattening film which consists of an insulator layer or acrylic material is formed on the source signal line 18, it insulates, and a picture element electrode is formed on this insulator layer. Thus, the composition which piles up a picture element electrode is called a high aperture (HA) structure on the source signal line 18. That is, the edge part of a source signal line and the edge part of a picture element electrode make it abbreviated-in agreement, or it is made for the edge part of a source signal line and the edge part of a picture element electrode to lap (an insulator layer is in an interlayer).
[0099]It lets the 1st transistor (TFT or switching element) 11a and 3rd transistor (TFT or switching element) 11c pass for the 1st gate signal line (the 1st scanning line) 17a being active (ON voltage is impressed) and by carrying out, the current value which should be passed to said EL element 15 is passed, and between the gate of the 1st transistor and a drain is short-circuited -- as -- the 2nd transistor 11b -- the 1st gate signal line 17a -- it opening being active (ON voltage is impressed) and by becoming, and. It is remembered that the gate voltage (or drain voltage) of the 1st transistor 11a passes said current value to the capacitor (a capacitor, storage capacitance) 19 connected between the gate of the 1st transistor 11a, and sauce.
[0100]As for the sauce inter gate capacity (capacitor) 19 of the 1st transistor 11a, it is preferred to consider it as 0.2-pF or more the capacity of 2 pF or less. As other composition, the composition which forms a capacitor is also illustrated separately. That is, it is the composition which forms storage capacitance from a capacitor electrode layer, gate dielectric film, and a gate metal. It is more desirable to constitute a capacitor from the viewpoint which prevents the brightness lowering by leak of the M3 transistor 11c, and a viewpoint for stabilizing a display action separately in this way.
[0101]The capacity of the capacitor 19 is fundamentally determined in proportion to 1 pixel size. It is preferred to consider it as the range of 0.2 pF or more per pixel size of 0.01 square milimeter 1.0 pF. It is preferred to consider it as the range of 0.3 pF or more per pixel size of 0.01 square milimeter 0.8 pF still more preferably. If the capacity of the capacitor 19 is small, fixed voltage cannot be held at 1 frame period, but a picture will serve as a flicker. When capacity is too large, it is made to fall remarkably with the numerical aperture of a pixel.
[0102]what the capacitor 19 is formed in general in the non display regions between the adjoining pixels for -- this -- better -- **. Generally, when creating full color organic electroluminescence, in order to form an organic electroluminescence layer by the mask deposition by a metal mask, the formation position of the EL layer by mask position gap occurs. When a position gap occurs, there is a danger that the organic electroluminescence layer of each color will lap. Therefore, not less than 10micro of non display regions between the pixels which each color adjoins must be left. This portion turns into a portion which does not contribute to luminescence. Therefore, it becomes an effective means for the improvement in a numerical aperture to form the storage capacitance 19 in this field.

[0103]Next, the 2nd gate signal line 17b is activated, using the 1st gate signal line 17a as inactive (OFF voltage is impressed), It operates so that it may change to the course containing the 4th transistor 11d by which the course into which current flows was connected to said 1st transistor 11a and EL element 15, and said EL element 15 and the memorized current may be sent through said EL element 15.
[0104]This circuit has the four transistors 11 in 1 pixel, and the gate of the 1st transistor M1 is connected to the sauce of the 2nd transistor M2, The gate of the 2nd transistor and the 3rd transistor M2 is connected to the 1st gate signal line 17a, the drain of M2 is connected to the sauce of M3, and the sauce of the 4th transistor M4, and the drain of M3 is connected to the source signal line 18. The gate of the transistor M4 is connected to the 2nd gate signal line 17b, and the drain of the transistor M4 is connected to the anode electrode of EL15.
[0105]P channel constitutes all the TFTF(s) from drawing 1. Although P channel has somewhat low mobility as compared with TFT of N channel, since pressure-proofing does not generate degradation easily greatly again, either, it is desirable. However, it does not limit only to this invention constituting EL element composition from a P channel. It may constitute only from an N channel and may constitute using both N channel and P channel.
[0106]The 3rd and 4th transistors are constituted from same polarity, and it constitutes from an N channel, and, as for the 1st and 2nd transistors, constituting from a P channel is preferred. Generally P channel transistor has a large effect which uses the 1st transistor 11a as P channel to the EL element which obtains the target luminescence intensity by there being the features, like reliable there is little kink current, and controlling current as compared with N channel transistor.
[0107]Hereafter, the EL element composition of this invention is explained using drawing 13. The EL element composition of this invention is controlled by two timing. The 1st timing is timing which makes a required current value memorize. When TFT11b and TFT11c turn on to this timing, it becomes drawing 13 (a) as an equivalent circuit. Here, the predetermined current I1 is written in from a signal wire. Thereby, TFT11a will be in the state where the gate and the drain were connected, and the current I1 will flow through it through this TFT11a and TFT11c. Therefore, the voltage of the gate sauce of TFT11a turns into the voltage V1 that I1 flows.
[0108]TFT11a and TFT11c close the 2nd timing, it is the timing which TFT11d opens and the equivalent circuit at that time serves as drawing 13 (b). The voltage V1 between the sauce gates of TFT11a becomes [being held with as, and]. In this case, the transistor 11a of M1 becomes constant [the current of I1] in order to always operate in a saturation region.
[0109]The gate of the transistor 11a and the gate of the transistor 11c are connected to the same gate signal line 11a. However, the gate of the transistor 11a and the gate of the transistor 11c may be connected to the different gate signal line 11 (it enables it to control SA1 and SA2 individually). That is, a 1-pixel gate signal line becomes three (the composition of drawing 1 is two). By controlling individually the ON/OFF timing of the gate of the transistor 11a, and the ON/OFF timing of the gate of the transistor 11c, the current value variation of EL element 15 by dispersion in the transistor 11 can be reduced further.
[0110]The 1st gate signal line 17a and 2nd gate signal line 17b are carried out in common, and if it is the conductivity type (N channel and P channel) which differed in the 3rd and 4th transistors, simplification of a drive circuit and the numerical aperture of a pixel can be raised.
[0111]If constituted in this way, as operation timing of this invention, the write-in course from a signal wire will be come by off. That is, when predetermined current is memorized, if the course into which current flows has branching, an exact current value will not be memorized by the sauce inter gate capacity (capacitor) of M1. By using TFTM3 and TFTM4 as different conducted type of current, after M3 certainly turns off to the timing from which a scanning line changes by controlling a mutual threshold, it enables M4 one.
[0112]However, since it is necessary to control a mutual threshold correctly in this case, cautions of a process are required. Although the circuit described above is realizable with at least four transistors, Even if cascade connection of the transistor 11e (M5) is carried out for Miller-effect reduction as shown in drawing 1 (b) and the total of a transistor becomes four or more so that more exact timing may control or mention later, the principle of operation is the same. Thus, by having composition which added the transistor 11e, the current programmed via the transistor M3 can pass now with more sufficient accuracy to EL element 15.
[0113]In the composition of drawing 1, it is still more preferred that the current value Ids in the saturation region of the 1st transistor 11a satisfies the conditions of a lower type. In a lower type, the value of lambda satisfies or less 0.06 0.01 or more conditions between the adjoining pixels.
[0114]

$$Ids=k*(Vgs-Vth)^2 (1+ Vds*lambda)$$

In this invention, although the working range of the transistor 11a is limited to a saturation region, it separates from the transistor characteristics in a saturation region from the ideal characteristic, and they are generally influenced by the voltage between sauce drains. This effect is called Miller effect.
[0115]The case where the shift of the threshold as for which deltaVt becomes each transistor 11a in the adjoining pixel occurs is considered. In this case, the current value memorized is the same. If the shift of a threshold is set to deltaL, abbreviation delta Vxlambda is equivalent to a gap of the current value of EL element 15 by changing the threshold of the transistor 11a. Therefore, it turns out that lambda must be below 0.01xx/y noting that y(V) is permitted between the pixels which adjoin the permissible dose of a shift of a threshold, in order to suppress a gap of current below to x (%).
[0116]This acceptable value changes with the luminosity of application. If the amount of change has not less than 2% of luminosity in the brightness area from 100-cd[/m]^2 to 1000-cd[/m]^2, human being will recognize the changed boundary line. Therefore, it is required for the amount of change of luminosity (current amount) to be less than 2%. When luminosity is higher than 100 cd/cm^2, the luminance variation of the adjoining pixel will be not less than 2%. When using EL display device of this invention as a display for personal digital assistants, the demand luminosity is a 100-cd[/m]^2 grade. When the pixel configuration of drawing 1 was actually made as an experiment and change of the threshold was measured, the adjoining pixel transistor 11a Set and it turned out that the maximum of change of a threshold is 0.3V.
[0117]Therefore, in order to suppress change of luminosity within 2%, lambda must be 0.06 or less. However, it is not necessary to carry out to 0.01 or less. It is because human being cannot recognize change. In order to attain the variation in this threshold,

it is necessary to enlarge transistor size enough, and it is unreal.
[0118]It is preferred to constitute so that the current value Ids in the saturation region of the 1st transistor 11a may satisfy a lower type. It may be 1% or more 5% or less between the pixels which change of lambda adjoins.
[0119]

$Ids=k*(Vgs-Vth)^2 (1+ Vds*lambda)$

If lambda of the above-mentioned formula has change even when change of a threshold does not exist even if between the adjoining pixels, the current value which flows through EL will be changed. In order to suppress change within **2%, change of lambda must be suppressed to **5%. However, it is not necessary however, to make it to 1% or less. It is because human being cannot recognize change. In order to attain 1% or less, it is necessary to enlarge transistor size fairly, and it is unreal.
[0120]According to an experiment, an array trial production, and examination, it is preferred that the channel length of the 1st transistor 11a sets to not less than 10 micrometers 200 micrometers or less. It is preferred that the channel length of the 1st transistor 11a sets to not less than 15 micrometers 150 micrometers or less still more preferably. This is considered to be because for an electric field to be eased and for a kink effect to be low suppressed, when the grain boundaries included in a channel increase in number when channel length L is lengthened.
[0121]The transistor 11 which constitutes a pixel is formed by the poly-Si TFT formed by the laser recrystallization method (laser annealing), and it is preferred that the direction of the channel in all the transistors is the same direction to the direction of radiation of laser.
[0122]Dispersion in transistor characteristics proposes the circuitry which does not affect a display, and four or more transistors are [therefore] required for the purpose of an invention of this patent. If the characteristic of four transistors does not gather when these transistor characteristics determine a circuit constant, it is difficult to ask for a suitable circuit constant. To the major axis direction of laser radiation, by the case where the direction of a channel is level, and the case of being vertical, the threshold and mobility of transistor characteristics differ from each other, and are formed.
[0123]The grade of dispersion is the same in both cases. Horizontally, if perpendicular, the average value of ****** of mobility and a threshold differs. Therefore, the more nearly same one of the direction of a channel of all the transistors which constitute a pixel is desirable.
[0124]When Cs and the OFF state current value of the 2nd transistor 11b are set to Ioff for the capacity value of the storage capacitance 19, it is preferred to satisfy a following formula.
[0125]3 It is preferred to satisfy a following formula to < Cs/Ioff < 24 pan preferably.
[0126]6 By setting the OFF state current of the < Cs/Ioff < 18 transistor 11b to 5 or less pA, it is possible to suppress change of the current value which flows through EL to 2% or less. This is because the electric charge stored between gate sauce (both ends of a capacitor) in the voltage non-writing state cannot be held between 1 fields, when leakage current increases. Therefore, if the capacity for accumulation of the capacitor 19 is large, the permissible dose of the OFF state current will also become large. Change of the current value between adjacent pixels can be suppressed to 2% or less by filling said formula.
[0127]It is preferred that the transistor which constitutes an active matrix is constituted by the p-ch polysilicon thin film transistor, and the transistor 11b considers it as the multi-gate structure which is more than a dual gate. In order that the transistor 11b may act as a switch between the sauce drains of the transistor 11a, the characteristic that an ON/OFF ratio is high as much as possible is required. The high characteristic of an ON/OFF ratio is realizable by making structure of the gate of the transistor 11b into the multi-gate structure beyond dual gate structure.
[0128]The transistor which constitutes an active matrix comprises a polysilicon thin film transistor, and it is preferred that below 54-micrometer^2 carries out (channel width W) * (channel length L). [of each transistor] (Channel width W) * (channel length L) and the variation of transistor characteristics have correlation.
[0129]The cause of dispersion in transistor characteristics has a large thing resulting from dispersion in the energy by the exposure of laser, etc., therefore in order to absorb this, it is desirable. [of the structure which contains many exposure pitches (generally about ten micrometers) of laser by the inside of a channel as much as possible] By below 54-micrometer^2 carrying out (channel width W) * (channel length L), there is no dispersion resulting from laser radiation, and the thin film transistor to which the characteristic was equal can be obtained. [of each transistor]
[0130]If transistor size becomes small too much, characteristic dispersion by area will occur. Therefore, it is made for (channel width W) * (channel length L) to become more than 9-micrometer^2. [of each transistor] As for (channel width W) * (channel length L), it is preferred to make it below 45-micrometer^2 become [more than 16 micrometer^2] still more preferably. [of each transistor]
[0131]Things are [making it mobility change of the 1st transistor 11a in the adjoining unit pixel be 20% or less] preferred. When mobility runs short, by the time the charging capacity of a switching transistor deteriorates and it passes a current value required for within a time, capacity between the gate sauce of M1 cannot be charged. Therefore, dispersion in the luminosity between pixels can be made below into ****** by suppressing dispersion in movement within 20%.
[0132]Although the pixel configuration explained the above explanation as composition of drawing 1, the above matter is applicable also to the composition illustrated to drawing 20 and drawing 21. Hereafter, composition, operation, etc. are explained about pixel configurations, such as drawing 20.
[0133]When setting up the current sent through EL element 15, voltage between gate sauce which produces the signal current sent through TFT11a in TFT11a as a result of [its] Iw is set to Vgs. Since between the gate drains of TFT11a has connected too hastily by TFT11d at the time of writing, the TFT11a operates in a saturation region. Therefore, Iw is given by the following formulas.
[0134]

$Iw=mu\ 1, Cox1 and W1/L1/2 (Vgs-Vth1)^2$ -- (1)

Here, Cox is the gate capacitance per unit area, and is given by Cox=epsilon 0 and epsilonr/d. The mobility of a career and W show channel width, L shows channel length, as for the threshold and mu which are TFT as for Vth, vacuous mobility and epsilonr show the specific inductive capacity of gate dielectric film, as for epsilon 0, and d is the thickness of gate dielectric film.

[0135]A current level will be controlled by TFT1b by which Idd is connected in series with EL element 15 if the current which flows into EL element 15 is set to Idd. In this invention, since the voltage between the gate sauce is in agreement with Vgs of (1) type, if it assumes that the TFT1b operates in a saturation region, the following formulas will be realized.
[0136]
Idrv=mu 2, Cox2 and W2/L2/2 (Vgs-Vth2) ^{2} -- (2)
Generally conditions for the insulated-gate electric field effect type thin film transistor (TFT) to operate in a saturation region are given by the following formulas by making Vds into the voltage between drain sauce.
[0137]
| Vds|>|Vgs-Vth| -- (3)
Here, since the inside of a small pixel is approached and it is formed, TFT11a and TFT11b are profile mu1=mu2 and Cox1=Cox2, and unless creativity in particular is put, they are considered to be Vth1=Vth2. Then, the following formulas are easily drawn from (1) type and (2) types at this time.
[0138]
Idrv/Iw=(W2/L2)/(W1/L1) -- (4)
Although it is common in (1) type and (2) types to vary for every pixel, every product, or every manufacture lot as for the value of mu, Cox, and Vth itself, the point which it should be careful of here, (4) Since a formula does not contain these parameters, I hear that it is not dependent on these dispersion, and there is a value of Idrv/Iw.
[0139]If it designs with W1=W2 and L1=L2, Idrv/Iw=1, i.e., Iw and Idrv, will become the same value. That is, since the driving current Idd which is not based on characteristic dispersion of TFT but flows into EL element 15 becomes the same as that of the signal current Iw correctly, it can control the light emitting luminance of EL element 15 correctly as a result.
[0140]since [as mentioned above,] Vth1 of TFT11a for conversion and Vth2 of TFT11b for a drive are fundamentally the same -- both TFT(s) -- if the signal level of a cutoff level is impressed to the gate which is in the common electric potential of ** mutually -- TFT11a and TFT11b -- it must be in both non-switch-on -- it comes out. However, Vth2 may become low rather than Vth1 by factors, such as dispersion in a parameter, also within a pixel actually. At this time, since the leakage current of subthreshold level flows into TFT11b for a drive, EL element 15 presents fine luminescence. The contrast of a screen falls by this fine luminescence, and display properties are spoiled.
[0141]Especially in this invention, it has set up so that threshold voltage Vth2 of TFT11b for a drive may not become lower than threshold voltage Vth1 of TFT11a for conversion corresponding within a pixel. For example, even if gate length L2 of TFT11b is made longer than the gate length L1 of TFT11a and it changes the process parameter of these thin film transistors, Vth2 is kept from becoming lower than Vth1. It is possible for this to control very small current leakage. The above matter is applied also to TFT11a of drawing 1, and the relation of TFT11d.
[0142]Transistor TFT11for conversion a into which signal current flows as shown in drawing 21, Transistor TFT11for drive b etc. which control the driving current which flows into the light emitting device which consists of EL element 15 grade. Transistor TFT11for taking in c which connects or intercepts a pixel circuit and data-line data by control of the 1st scanning line scanA (SA), The voltage between gate sauce of transistor TFT11d for a switch and TFT11a which write in by control of the 2nd scanning line scanB (SB), and short-circuit the gate drain of TFT1111a during a period, It comprises the capacity C19 for holding after a write end, EL element 15 as a light emitting device, etc. Therefore, since gate signal lines are each two pixels, they can apply the composition of the whole specification of this invention explained by drawing 1, drawing 2, drawing 3, etc. which were explained above, a function, operation, etc.
[0143]Although TFT11c consists of drawing 21 and the transistor of N-channel MOS (NMOS) and others is constituted from a P channel MOS (PMOS), this needs to be an example and does not necessarily need to be this passage. Although the terminal of one of these is connected to the gate of TFT11a and the terminal of another side is connected to Vdd (power supply potential), constant potential not only Vdd but arbitrary may be sufficient as the capacity C. The cathode (negative pole) of EL element 15 is connected to earth potentials. Therefore, it cannot be overemphasized that the above matter is applied to drawing 1 etc.
[0144]The composition of drawing 21 is provided with the following.
The scanning line driving circuit which chooses the scanning lines scanA and scanB one by one.
The data line driving circuit containing current source CS which generates the signal current Iw which has a current level according to brightness information, and is supplied to data-line data one by one.
Two or more pixels which it is allotted to the intersection of each scanning lines scanA and scanB and each data-line data, and contain current drive type EL element 15 which emits light in response to supply of driving current.

[0145]As feature items, the pixel configuration shown in drawing 21, The accession department which incorporates the signal current Iw from the data-line data concerned when the scanning line scanA concerned is chosen, It consists of a converter which once transforms the current level of the incorporated signal current Iw into a voltage level, and holds it, and an actuator which sends the driving current which has a current level according to the held voltage level through the light emitting device OLED concerned. Specifically, said accession department consists of transistor TFT11for taking in c.
[0146]Said converter contains the capacity C connected with thin film transistor TFT11a for conversion provided with a gate, sauce, the drain, and the channel at the gate. A gate is made to generate the voltage level which sent through the channel the signal current Iw incorporated by thin film transistor TFT11for conversion a, and the accession department, and was changed, and the voltage level produced in capacity C19-TO is held.
[0147]Said converter contains thin film transistor TFT11d for a switch inserted between the thin film transistor TFT11a drain for conversion, and the gate. Thin film transistor TFT11d for switching flows, when transforming the current level of the signal current Iw into a voltage level, the drain and gate of thin film transistor TFT11a for conversion are electrically connected, and the gate of TFT11a is made to produce the voltage level on the basis of sauce. Thin film transistor TFT11d for a switch is intercepted when holding a voltage level in the capacity C, and it separates the capacity C19 linked to the gate of thin film transistor TFT11a for conversion, and this from the drain of TFT11a.
[0148]Said actuator contains thin film transistor TFT11b for a drive provided with a gate, a drain, sauce, and a channel. Thin film transistor TFTb for a drive sends through EL element 15 the driving current which accepts in a gate the voltage level held at the

capacity C19, and has a current level according to it via a channel. The gate of thin film transistor TFT11a for conversion and the gate of thin film transistor TFT11b for a drive are connected directly, and he constitutes a current mirror circuit, and is trying for the current level of the signal current Iw and the current level of driving current to serve as proportionality.
[0149]The thin film transistor TFT11b for a drive operates in a saturation region, and sends through EL element 15 the driving current according to the difference of the voltage level and threshold voltage which were impressed to the gate.
[0150]Thin film transistor TFT11b for a drive is set up so that the threshold voltage may not become lower than the threshold voltage of thin film transistor TFT11a for conversion corresponding within a pixel. Specifically, TFT11b is set up so that the gate length may not become shorter than the gate length of TFT11A. Or TFT11b may be set up so that the gate dielectric film may not become thinner than the gate dielectric film of TFT11a corresponding within a pixel.
[0151]Or TFT11b may adjust the impurity concentration poured into the channel, and it may set it up so that threshold voltage may not become lower than the threshold voltage of TFT11a corresponding within a pixel. As for TFT11a and TFT11b, both should be turned off, if the signal level of a cutoff level is impressed to the gate of both the thin film transistors by which common connection was carried out when it sets up temporarily so that the threshold voltage of TFT11a and TFT11b may become the same. However, dispersion in a process parameter is also in a pixel slightly actually, and the threshold voltage of TFT11b may become low from the threshold voltage of TFT11a.
[0152]At this time, since the weak current of subthreshold level flows into TFT11b for a drive also with the signal level below a cutoff level, EL element 15 fine-emits light and the contrast drop of a screen appears. Then, gate length of TFT11b is made longer than the gate length of TFT11a. Even if it changes the process parameter of a thin film transistor within a pixel, the threshold voltage of TFT11b is kept from becoming lower than the threshold voltage of TFT11a by this.
[0153]In gate length L, in the comparatively short short-channel-effect field A, Vth goes up with the increase in gate length L. On the other hand, gate length L is not concerned with gate length L in the comparatively big suppression region B, but Vth is almost constant. Gate length of TFT11b is made longer than the gate length of TFT11a using this characteristic. For example, when the gate length of TFT11a is 7 micrometers, the gate length of TFT11b shall be about 10 micrometers.
[0154]While the gate length of TFT11a belongs to the short-channel-effect field A, the gate length of TFT11b may be made to belong to the suppression region B. Thereby, while being able to inhibit the short channel effect in TFT11b, the threshold voltage reduction by change of a process parameter can be controlled.
[0155]By the above, the leakage current of the subthreshold level which flows into TFT11b can be controlled, fine luminescence of EL element 15 can be suppressed, and it can contribute to a contrast improvement.
[0156]The drive method of the pixel circuit shown in drawing 21 is explained briefly. First, at the time of writing, the 1st scanning line scanA and the 2nd scanning line scanB are made into a selective state. By connecting current source CS to data-line data, where both scanning lines are chosen, the signal current Iw according to brightness information flows into TFT11a. Current source CS is a variable current source controlled according to brightness information. At this time, since it has connected too hastily electrically by TFT11d between the gate drains of TFT11a, (3) types are materialized, and the TFT11a operates in a saturation region. Therefore, between the gate sauce, the voltage Vgs given by (1) formula arises.
[0157]Next, scanA and scanB are changed into a non selection state. In detail, TFT11d is first changed into an off state by making scanB into a low. Vgs is held by this with the capacity C19. Next, since a pixel circuit and data-line data are electrically intercepted by making scanA into a high level and setting to OFF, the writing to another pixel can be performed via data-line data after that. Here, the data which current source CS outputs as a current level of signal current needs to be effective when scanB serves as non selection, but it may be used as arbitrary levels (for example, write data of the following pixel) after that.
[0158]Since common connection of TFT11a, a gate, and the sauce is carried out [both], and TFT11b approaches the inside of a small pixel and is formed, If the TFT11b is operating in the saturation region, the current which flows through TFT11b will be given by (2) formulas, and will turn into the driving current Idd which flows into this [15], i.e., an EL element. What is necessary is just to give sufficient power supply potential to Vdd so that (3) types may be materialized in addition even if it takes into consideration the voltage drop in EL element 15 in order to operate TFT11b in a saturation region.
[0159]In drawing 21 and drawing 22, the current mirror ratio of TFT (11a, 11b) which carries out the cause of the current mirror like this is good to use 15 or less [3 or more]. It is good to use ten especially or less [5 or more]. Here, in the current mirror ratio 5, if the current which flows into the sauce drain of TFT11a sets to 5microA, it will say designing the current which flows into the sauce drain of TFT11b to 1microA, for example. The transistor size of TFT11a and 11b can design a current mirror ratio freely.
[0160]The above easy current mirror ratio is made or more into one in order to make small influence of the parasitic capacitance of the source signal line 18. When performing a current drive like drawing 1 and drawing 21, in a black display, the current which flows into the source signal line 18 becomes small. Therefore, it is because time is needed for the charge and discharge of this parasitic capacitance and it becomes impossible to write the voltage of regulation to the capacitor 19 of a pixel in 1H (one horizontal scanning period) period, when parasitic capacitance (sauce gate signal line cross capacity etc.) is large to the source signal line 18.
[0161]In order to solve this technical problem, it is good to enlarge the current which flows into a source signal line. Therefore, it comes to be fully able to carry out the charge and discharge also of the parasitic capacitance by making a current mirror ratio or more into one. However, if a current mirror ratio is enlarged too much, the power consumption of the source drivers IC 14 will become large.
[0162]As for K, when a current mirror ratio is set to K, capacity of one source signal line seen from the output stage of the source drivers IC (circuit) 14 is set to ApF and write-in maximum current is set to ImuA, it is preferred that C/(I-10) above uses the range below C/I.
[0163]In the composition of drawing 1, capacity of one source signal line seen from the output stage of the source drivers IC (circuit) 14 is set to ApF, As for T, when write-in maximum current is set to ImuA and 1 horizontal-scanning time (1H) is set to Tmicrosec, it is preferred that more than (4andC)/I (20andC) uses the range below /I.
[0164]Like drawing 1 (b) etc., in order to increase impedance, it cannot be overemphasized that TFT11e and 11 f may be added so that it may illustrate [purpose] to drawing 22. Thus, a better current drive is realizable by adding TFT11e and 11 f. drawing 1 explains other matters -- it comes out and omits.

[0165]Thus, direct current voltage was impressed to EL display device explained by produced drawing 1, drawing 21, etc., and the continuation drive was carried out by the constant current density of 10 mA/cm2. EL structure has checked green (luminescence maximum wavelength lambdamax = 475 nm) luminescence of two of 7.0V and 200cds/cm.
[0166]A blue light part is luminosity 100cd/cm2, the color coordinate of x= 0.15, y= 0.17, and a green emission part was luminosity 250cd/cm2, the color coordinate of x= 0.34, y= 0.63, and a red light part is luminosity 150cd/cm2, and the color coordinate was acquired for the luminescent color of x= 0.65 and y= 0.34.
[0167]Hereafter, the inspection method and test equipment are explained one by one about the composition explained by drawing 1, drawing 21, etc.
[0168]First, many is simultaneously formed in the one substrate 231 (for example, glass substrate) so that the array substrate (substrate with which the switching element was formed) 49 which constitutes a display panel may be illustrated to drawing 23 (production). In order that each array substrate 49 may prevent a switching element or the gate driver circuit 12 etc. which constitutes a pixel etc. from static electricity, the sheet ring 232 is formed.
[0169]The electric short circuit of the short ring 232 is carried out [gate signal line 17 and source signal line 18]. It consists of metal thin films, such as chromium (Cr) and aluminum (aluminum), as a component.
[0170]In drawing 23, the short ring of each array substrate 49 is illustrated so that it may be independently, but it may not be limited to this, and two or more short rings may form it in a short condition. The short ring haves to make no neighborhoods a short condition, and the number of them may be two. It is good also as a connected state using a diode between the short ring of each neighborhood, and the short ring of other neighborhoods. Such composition is also in an electric short circuit state.
[0171]Drawing 24 is a lineblock diagram of the array substrate 49 of one sheet. Although each pixel 16 has illustrated the composition illustrated to drawing 1, drawing 21, or drawing 22, it may not be limited to this, and the composition of drawing 38 may be sufficient as it, for example.
[0172]The short ring 232b makes the gate signal line 17 the electric short condition. The short ring 232a makes the source signal line 18 the electric short condition. The short ring 232a and the short ring 232b are connected by the cut section 241. In this cut section 241, it is formed with the monolayer of chromium (Cr), or monolayers, such as molybdenum, and it is constituted so that the short rings 232a and 232b may be easily made into a cutting condition electrically by the exposure of a laser beam, etc. It cannot be overemphasized easily that the composition which narrowed the width of the cutting part from other portions may be used for cutting.
[0173]In addition, it may be the composition which forms a diode in a cut section simultaneously with formation of the switching element of a pixel, and is made into an electric break state corresponding to the applying direction of voltage. In addition, it may constitute so that the voltage which formed the resistor of high resistance in the cut section comparatively, for example, was impressed to the short ring 232b may not be transmitted to the short ring 232a by the voltage drop of a resistor.
[0174]242 is a terminal electrode for connecting with the terminal electrode of the source drivers IC 14. The terminal electrode 242 and the terminal of the source drivers IC 14 are connected with COG (chip one glass) art. By cutting the short ring 232a, the terminal electrode 242 is separated separately.
[0175]After considering it as the array substrate 49 or a display panel, in order to inspect, the cut section 241 is cut first. Vdd voltage (anode voltage) is impressed to the terminal 62. Vs1 voltage (cathode voltage) is impressed to the terminal 61.
[0176]Drawing 25 is test equipment and an explanatory view of an inspection method. The voltage [one / voltage / the switching element 11b etc.] (it is hereafter called ON state voltage) is impressed to the short ring 232b. 253 is a signal source. The signal source 253b outputs the OFF state voltage which turns OFF ON state voltage or a switching element. In the case of drawing 1, ON state voltage is 12(V)s and, specifically, OFF state voltage is -2(V). Said ON state voltage is impressed to the short ring 232b by the probe 251b. Therefore, ON state voltage is impressed to all the gate signal lines 17.
[0177]On the other hand, the signal source 253c generates Vdd voltage, and is impressed to the terminal 62 via the probe 251c. Specifically, Vdd voltage is 12(V)s. The signal source 253a generates Vs1 voltage, and is impressed to the terminal 61 via the probe 251a. Specifically, Vs1 voltage is 0(V). As shown in drawing 25, the observer 252 observes the lighted condition of an EL element optically by eyes directly, and also observation or any which are measured detected, or photosensor detects and that it is sufficient observes may be sufficient as it by observing measuring with a CCD camera, or scanning with a scanner.
[0178]On the other hand, the short ring 232a is made into an open condition. That is, it is an opened condition. High resistance may be sufficient as an opened condition, opening may be sufficient as it by mechanical switches, such as a relay, and the electric opened condition by photo-diode, a photo transistor, etc. may be sufficient as it.
[0179]Although explained in a specification impressing the same voltage to all the gate signal lines 17, and making all the source signal lines into an open condition, it is for this explaining easily. Therefore, it cannot be overemphasized that what is necessary is just to control the signal wire of only a required part in an inspection.
[0180]In the composition of drawing 1, if ON state voltage is impressed to the gate signal lines 17a and 17b, TFT11b and 11c and 11d will become about an ON state. Therefore, the equivalent circuit of a pixel becomes like drawing 26. The current I which the source signal line 18 does not flow through the current Is for an open condition, but flows through drive TFT11a turns into the current Idd which flows into EL element 15 altogether.
[0181]Since ON state voltage is impressed to all the gate signal lines 17 in the state of drawing 25, all the pixels will be in the state of drawing 26. Therefore, all the pixels currently displayed on the display panel will be in a lighted condition. If there is a pixel of an astigmatism light state, TFT has broken or capability will be low.
[0182]The pixel of a viewing area can be inspected by the ability to make it a lighted condition by impressing voltage etc. as mentioned above. The characteristic of EL element 15, etc. are optically [directly] observable by changing Vdd voltage. It is easy to also observe the capability of TFT11a.
[0183]If it constitutes so that the gate terminal of TFT11b and the gate terminal of TFT11c can be individually controlled in drawing 1, in the state of drawing 26, TFT11b can be made one and TFT11c can be maintained simultaneously at OFF. Therefore, a good inspection can be conducted even if voltage or current is impressed to the source signal line 18.
[0184]A performance judgment of the characteristic of EL element 15 and drive TFT11a, etc. can be exactly made more by changing the voltage impressed to a gate signal line as shown in drawing 27. Drawing 27 (a) shows anode voltage. If drawing 27 (b) impresses voltage to the gate signal lines 17a and 17b like, it will be in the state of drawing 26. To the gate signal line 17, if it

impresses like drawing 27 (c), the capacitor 19 will repeat charge and discharge.
[0185]Therefore, the displaying condition of an EL display panel can be changed by changing the cycle of the driving waveform impressed to a gate signal line like drawing 28 (d). If OFF state voltage is impressed to the gate signal line 17 as shown in drawing 27 (e) after that after charging the capacitor 19, the electric charge of the capacitor 19 will be discharged and the display luminance of an EL display panel will fall gradually. If the state of this fall is observed or measured, it can be alike, and the retention of a display panel, etc. can be measured more.
[0186]Capability or a defect of an EL element produced when changing the gate voltage waveform, as shown in drawing 27 (c), (d), and (e) can be detected or inspected for a short period of time. Even if it changes Vdd voltage or Vs1 voltage, it cannot be overemphasized that display ability or a state of impairment of an EL panel, etc. can be measured or inspected.
[0187]Drawing 28 is the composition which formed the gate driver circuit 12 in the array substrate 49 directly by low-temperature-polysilicon art or elevated-temperature polysilicon technology. The difference with drawing 24 is a point without the cut section 241. As drawing 2 also explained, the gate driver 12 can impress ON state voltage or OFF state voltage to the arbitrary terminals of the gate signal lines 17a and 17b from that of operating a shift register circuit or an enable circuit.
[0188]It cannot be overemphasized that the source driver circuit 14 may be directly formed in the array substrate 49 by low-temperature-polysilicon art or elevated-temperature polysilicon technology.
[0189]Therefore, in the composition of drawing 28, the inspection method explained by drawing 26 and drawing 27 can be easily enforced by controlling the gate driver circuit 12. It is less necessary for probing to the short ring 232b. Since drawing 25, drawing 26, drawing 27, etc. explain other composition or methods, explanation is omitted.
[0190]Drawing 29 short-circuits the gate signal line 17a with the short ring 232a, and the gate signal line 17b is the composition which short-circuited with the short ring 232c. When inspecting the array substrate 49 or an EL display, the cutting parts 241a and 241b are cut like drawing 24.
[0191]The gate signal line 17a and the gate signal line 17b of drawing 29 can be individually controlled now. Therefore, TFT11b, 11c (connected to the gate signal line 17a), and TFT11d (connected to the gate signal line 17b) are controllable by the composition of drawing 26 independently. This inspection method explains using drawing 30.
[0192]With the composition of drawing 29, current or voltage is impressed to a source signal line. As an apply means, the source driver circuit 14 may be used and a signal generation means may be used separately. Here, in order to explain easily, it explains noting that voltage is impressed.
[0193]First, as shown in drawing 30 (a), the voltage V1 is impressed to the source signal line 18. Under the present circumstances, ON state voltage is impressed to the gate signal line 17a, and TFT11b and TFT11c which are shown in drawing 1 are made one. OFF state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made to turn off. Then, the voltage V1 is impressed to the capacitor 19. The voltage V2 currently held at the capacitor 19 is read after predetermined time. By carrying out this operation, the existence of the defect of the retention capacity of a capacitor and TFT11b, and TFT11c can be inspected.
[0194]When inspecting TFT11d, after making voltage hold to the capacitor 19 as shown in drawing 30 (a), OFF state voltage is impressed to the gate signal line 17a, and TFT11b and TFT11c which are shown in drawing 1 are made to turn off. ON state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made one. Then, since it is generated by the path of the current Idd and current flows into EL element 15, EL element 15 lights up. Therefore, the existence of the defect of TFT11d, the capability of an EL element, or the existence of a defect is detectable.
[0195]The composition of drawing 1 (b) of the matter explained above is also the same. It is because it will become the composition of drawing 1 (a) if ON state voltage is impressed to a Vbb terminal and TFT11e is made one.
[0196]If it constitutes so that the gate signal line which controls TFT11b, and the gate signal line which controls the gate signal line and TFT11d which controls TFT11c may be controlled individually, a still better inspection can be conducted. In this case, the gate signal line of each pixel becomes three.
[0197]Drawing 31 is an explanatory view of an inspection method in case there are three gate signal lines. It cannot be overemphasized that the inspection method explained by drawing 30 with the natural thing can be enforced.
[0198]With the composition of drawing 29, current or voltage is impressed to a source signal line. As an apply means, the source driver circuit 14 may be used and a signal generation means may be used separately. Here, in order to explain easily, it explains noting that voltage is impressed.
[0199]First, as shown in drawing 31 (a), the voltage V1 is impressed to the source signal line 18. Under the present circumstances, TFT11b and TFT11c which are shown in drawing 1 are made the one by impressing ON state voltage to the gate signal line 17a. TFT11d connected to EL element 15 is made to turn off by impressing OFF state voltage to the gate signal line 17b.
[0200]By controlling TFT11 as mentioned above, EL element 15 is separated from a source signal line, and it can inspect, without being influenced by EL element 15. Although the voltage V1 is impressed, it may be thought that this impresses current to the source signal line 18. Drawing 30 (a) of the above matter is also the same.
[0201]The voltage V1 is impressed to the capacitor 19. The voltage V2 (it assumes changing) currently held at the capacitor 19 is read after predetermined time. By carrying out this operation, the existence of the defect of the retention capacity of a capacitor and TFT11b, and TFT11c can be inspected. Although the voltage V2 is read, measuring the direction into which current besides measuring voltage concretely flows, and a size is also included. Only detecting the existence in a paddle with voltage is also included. Drawing 30 (a) of the above matter is also the same.
[0202]When inspecting TFT11c, after making voltage hold to the capacitor 19 as shown in drawing 31 (b), OFF state voltage is impressed to TFT11b and TFT11d, and TFT11c is made one. Then, the path of the current Idd can make it generate. In this case, EL element 15 can be measured, without switching on the light. The driving ability of TFT11a can be measured by this inspection, and the existence of the defect of TFT11c can also be inspected. By monitoring the current Idd (or voltage outputted) which furthermore flows, the retention capacity or holding property of the capacitor 19 can be inspected.
[0203]When inspecting TFT11d, after making voltage hold to the capacitor 19 as shown in drawing 30 (b), TFT11b and TFT11c are made to turn off. ON state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made one. Then, since it is generated by the path of the current Idd and current flows into EL element 15, EL element 15 lights up.

Therefore, the existence of the defect of TFT11d, the capability of an EL element, or the existence of a defect is detectable.
[0204]In order to inspect EL element 15, TFT11c and TFT11d are made to turn off, as shown in drawing 31 (c). The path which can send current directly is made into EL element 15 from the source signal line 18. Therefore, the current Idd can be sent through an EL element. The voltage of the anode of EL element 15 comes to monitor directly.
[0205]By sending current through EL element 15, and turning current on and off, the characteristic of EL element 15 can be evaluated and TFT11c and existence with a defect of 11 d, the capability of an EL element, or the existence of a defect can be detected.
[0206]Drawing 32 is the composition which formed the gate driver circuit 12 and the source driver circuit 14 in the array substrate 49 directly by low-temperature-polysilicon art or elevated-temperature polysilicon technology.
[0207]Therefore, in the composition of drawing 32, the inspection method explained by drawing 26 and drawing 27 can be easily enforced by controlling the gate driver circuit 12 like drawing 28. It is less necessary for probing to the short ring 232b. As drawing 30 and drawing 31 explained by control of the source driver circuit 14, arbitrary voltage can be easily impressed now to the source signal line 18.
[0208]The source driver circuit 14 comprises the switching circuits 334 etc. which were constituted when TFT of the shift register 22b, P channel, and N channel served as a group, such as a transfer gate (TG), the inverter circuit 23, and an analog switch, as illustrated by drawing 33. Since the inverter circuit 23 and the matter explained by drawing 2 about the composition (a number of stages, a size, capability, etc.) of TG are applied, explanation is omitted.
[0209]The number of stages of the inverter 23 connected to TG333 is constituted so that one steps may differ by P channel and N channel of TG333. Therefore, one TG is turned on and off with the output of the shift register 22b. A video signal is impressed to the source terminal of TG333 by the video signal line 331. Although there is one video signal line in drawing 33, when performing a colored presentation, the video signal of R, G, and B is formed, and when the capability (mobility etc.) of TG or a shift register is low, it is divided into plurality and drives. Therefore, each video signal line also becomes [two or more].
[0210]Although the source driver circuit 14 currently explained by drawing 33 is explained supposing a point sequential drive, It may be not the thing to limit to this but a line sequential drive, and it cannot be overemphasized that any of the thing using DA circuits, such as a R-DA method, or the thing using a sample hold circuit may be sufficient. Since drawing 25, drawing 26, drawing 27, etc. explain other composition or methods, explanation is omitted.
[0211]The feature of drawing 33 is the point of providing the switch 334 in a connected part with the source signal line 18. The switch 334 means all the things which make between two points of contact, such as mechanical relay, photo relay, etc. besides the analog switch which consists of TFT(s), turn on and off. It cannot be overemphasized that it may constitute so that the switch 334 which it illustrates so that all the switches 334 can be controlled by the switch control line 332, but is not limited to this, and has been arranged at each source signal line 18 can control individually.
[0212]It cannot be overemphasized that a switch is illustrated as formed in the source driver 14, but it may not be limited to this, and the pixel TFT may be simultaneously formed in the array substrate 49. Separately, an IC form may be carried out and it may mount in an array substrate.
[0213]By constituting like drawing 33, the source driver circuit 14 is separable from the source signal line 18 of an array by carrying out the switch 334 to open. At the time of an inspection, voltage or current can be impressed to the arbitrary source signal lines 18. [being arbitrary (predetermined)] Therefore, inspection of the array substrate 49 or an EL display panel and evaluation can be carried out easily.
[0214]Although the above matter explained focusing on drawing 1, even if the test equipment and the inspection method of this invention are the composition of drawing 21 and drawing 22, they can be enforced. This explains using drawing 34. In order to explain easily, the configuration status of an array explains by mentioning drawing 29 as an example (of course, that they may be drawing 24, drawing 32, etc. are not the now to say, either).
[0215]Drawing 29 short-circuits the gate signal line 17a with the short ring 232a, and the gate signal line 17b is the composition which short-circuited with the short ring 232c. When inspecting the array substrate 49 or an EL display, the cutting parts 241a and 241b are cut like drawing 24.
[0216]The gate signal line 17a and the gate signal line 17b of drawing 29 can be individually controlled now. Therefore, TFT11b, 11c (connected to the gate signal line 17a), and TFT11d (connected to the gate signal line 17b) are controllable by the composition of drawing 26 independently.
[0217]With the composition of drawing 29, current or voltage is impressed to a source signal line. As an apply means, the source driver circuit 14 explained by drawing 33 may be used, and a signal generation means may be used separately. Here, in order to explain easily, it explains noting that voltage is impressed.
[0218]First, ON state voltage is impressed to the gate signal lines 17a and 17b, and TFT11c and TFT11d are made one as shown in drawing 34 (a). The voltage V1 (or current) is impressed to the source signal line 18. Then, the voltage V1 is impressed to the capacitor 19, current flows, current flows also into TFT11b by the effect of a current mirror simultaneously, and EL element 15 lights up. [TFT11a] The lighted condition of EL element 15 can be changed by changing the voltage V1 to impress.
[0219]The voltage V2 currently held at the capacitor 19 is read after predetermined time. By carrying out this operation, the existence of the defect of the retention capacity of a capacitor and TFT11c, and TFT11d can be inspected.
[0220]When inspecting TFT11d, after making voltage hold to the capacitor 19 as shown in drawing 34 (b), OFF state voltage is impressed to the gate signal lines 17a and 17b, and TFT11c and TFT11d which is shown in drawing 21 are made to turn off. Then, one [with the electric charge held at the capacitor 19 / TFT11d connected to EL element 15]. Then, since it is generated by the path of the current Idd and current flows into EL element 15, EL element 15 lights up. Therefore, the existence of the defect of TFT11b, the capability of an EL element, or the existence of a defect is detectable.
[0221]The composition of drawing 22 of the matter explained above is also the same. It is because it will become the composition of drawing 21 if ON state voltage is impressed to a Vbb terminal and TFT11e and TFT11f are made one. Since the matter about other inspection methods, test equipment, etc. is [the same or] the same as the matter which explained drawing 1 as a center, explanation is omitted.
[0222]Although grounded on Vdd voltage, the end of the capacitor 19 may consist of the above examples so that it may illustrate to drawing 35. One terminal of the capacitor 19 is connected with the capacitor signal wire 351 in drawing 35. The

capacitor signal wire 351 is pulled out by the gate signal line 17 and the uniform direction, takes the gate signal line 17 and a synchronization, and as it can control the pressure value impressed to things 1 signal wire, it is controlled. Generally, unless the gate voltage Vg becomes less than -4(V) to Vdd, current does not flow through TFT of P channel. In this state, the voltage impressed to the source signal line 18 needs to drive -4(V) as a base. Therefore, amplitude becomes large.

[0223]In order to solve this technical problem, Vdd voltage is impressed to the capacitor signal wire 351 in the state where it was made one [c / TFT11b and / 11] so that it may illustrate to drawing 36 (a). The voltage V3 from which predetermined current is acquired on the basis of the voltage [one / the voltage / P channel TFT11a] V0 is impressed to the source signal line 18.

[0224]Next, TFT11b and TFT11c are turned off and voltage of the capacitor signal wire 351 is made into V0 voltage. Then, Vg voltage of TFT11a of P channel is set to V0+V3, and can acquire desired current.

[0225]An inspection method impresses the voltage V1 to the source signal line 18, as shown in drawing 36 (a). Under the present circumstances, ON state voltage is impressed to the gate signal line 17a, and TFT11b and TFT11c which are shown in drawing 1 are made one. OFF state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made to turn off. Then, the voltage V1 is impressed to the capacitor 19.

[0226]The voltage V2 currently held at the capacitor 19 is read after predetermined time. By carrying out this operation, the existence of the defect of the retention capacity of a capacitor and TFT11b, and TFT11c can be inspected. By changing the pressure value of the capacitor signal wire 351, the output voltage V2 can be changed and the capability of the capacitor 19 can be judged.

[0227]When inspecting TFT11d, after making voltage hold to the capacitor 19 as shown in drawing 36 (a), OFF state voltage is impressed to the gate signal line 17a, and TFT11b and TFT11c which are shown in drawing 1 are made to turn off. ON state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made one. Then, since it is generated by the path of the current Idd and current flows into EL element 15, EL element 15 lights up. Therefore, the existence of the defect of TFT11d, the capability of an EL element, or the existence of a defect is detectable.

[0228]When inspecting TFT11c, after making voltage hold to the capacitor 19 as shown in drawing 36 (b), OFF state voltage is impressed to TFT11b and TFT11d, and TFT11c is made one. Then, the path of the current Idd can make it generate. In this case, EL element 15 can be measured, without switching on the light. The driving ability of TFT11a can be measured by this inspection, and the existence of the defect of TFT11c can also be inspected.

[0229]By monitoring the current Idd (or voltage outputted) which furthermore flows, the retention capacity or holding property of the capacitor 19 can be inspected. By changing the pressure value of the capacitor signal wire 351, the output current Idd can be changed and the capability of TFT11a can be judged.

[0230]When inspecting TFT11d, after making voltage hold to the capacitor 19 as shown in drawing 36 (b), TFT11b and TFT11c are made to turn off. ON state voltage is impressed to the gate signal line 17b, and TFT11d connected to EL element 15 is made one. Then, since it is generated by the path of the current Idd and current flows into EL element 15, EL element 15 lights up. Therefore, the existence of the defect of TFT11d, the capability of an EL element, or the existence of a defect is detectable. By changing the pressure value of the capacitor signal wire 351, the output voltage V2 can be changed and the capability of the capacitor 19, etc. can be judged.

[0231]In order to inspect EL element 15, TFT11c and TFT11d are made to turn off, as shown in drawing 36 (c). The path which can send current directly is made into EL element 15 from the source signal line 18. Therefore, the current Idd can be sent through an EL element. The voltage of the anode of EL element 15 comes to monitor directly.

[0232]By current's passing to EL element 15, and turning current on and off, the characteristic of EL element 15 can be evaluated and TFT11c and existence with a defect of 11 d, the capability of an EL element, or the existence of a defect can be detected. By changing the pressure value of the capacitor signal wire 351, the output voltage V2 can be changed and the capability of the capacitor 19 can be judged.

[0233]In drawing 35, although the capacitor signal wire 351 assumed that it is controlled to be able to control the pressure value which is pulled out by the gate signal line 17 and the uniform direction, takes the gate signal line 17 and a synchronization, and is impressed to things 1 signal wire, it is not a limiting-to this thing. The capacitor signal wire 351 may be made into two or more pixel rows in common. Therefore, an above-mentioned drive or an inspection etc. can be carried out also by constituting so that voltage may be identically impressed to the capacitor signal wire 351 of two or more pixel rows.

[0234]Although the above example was related with the composition of drawing 1, it is the same also about drawing 21 and drawing 22. Since operation is the same as that of drawing 36, explanation is omitted. It is also the same as as shown in drawing 38, when a pixel comprises two TFT(s). In this case, what is necessary is just to constitute like drawing 39.

[0235]In the test equipment or the inspection method of this invention, although EL element 15 is made to turn on and being inspected, it does not limit to this. For example, in drawing 26, even if there is no EL element 15, the quality of TFT11a, and 11b and 11c and the characteristic of the capacitor C can be inspected by controlling turning on and off of TFT11b and 11c. That is, an inspection etc. can be conducted even if it is in an array state. Also in drawing 30, drawing 31, and drawing 35, it is the same. Also in drawing 34, even if there is no EL element 15, the quality of TFT11a, and 11b and 11c and the characteristic of the capacitor C can be inspected by controlling turning on and off of TFT11d and 11c. That is, sufficient inspection can be conducted even if it is in an array state. Also in drawing 37, it is the same. Therefore, it is effective to inspect TFT in the state of an array first, before forming EL element 15 (before vapor-depositing EL film), to form EL element 15 and to inspect again in the panel-ized state.

[0236]Hereafter, the display, display module and information display device using drawing 1, drawing 21, drawing 22, etc., a drive circuit, a drive method for the same, etc. are explained.

[0237]In a full color organic EL panel, improvement in a numerical aperture becomes an important developing theme. It is for the utilization efficiency of light increasing and leading to a rise in luminosity or reinforcement, if a numerical aperture is raised. What is necessary is just to make small area of TFT which interrupts the light from an organic electroluminescence layer, in order to raise a numerical aperture.

[0238]Low-temperature polycrystal Si-TFT has one 10 to 100 times the performance of this as compared with an amorphous silicon, and since the serviceability of current is high, it can make the size of TFT very small. Therefore, in an organic EL panel, it

is preferred to produce a picture element transistor and a circumference drive circuit with low-temperature-polysilicon art. Of course, although it may form with amorphous silicon art, a pixel numerical aperture will become quite small.
[0239]By forming drive circuits, such as the gate driver 12 or the source driver 14, on the glass substrate 46, the resistance which becomes a problem especially by the organic EL panel of a current drive can be lowered. The connection resistance of TCP is lost, and also the leading line from an electrode becomes short 2-3 mm compared with the case of TCP connection, and wiring resistance becomes small. Suppose that there is an advantage whose process for TCP connection is lost that material cost falls.
[0240]Next, the EL display panel or EL display of this invention is explained. Drawing 2 is an explanatory view centering on the circuit of an EL display. The pixel 16 is arranged or formed in matrix form. The source driver 14 which outputs the current which performs current programming of each pixel to each pixel 16 is connected. The current mirror circuit corresponding to the number of bits of the video signal in the output stage of the source driver 14 is formed.
[0241]For example, if it is 64 gradation, 63 current mirror circuits are formed for every source signal line, and it is constituted by choosing the number of these current mirror circuits so that desired current can be impressed to the source signal line 18. The minimum output current of the current mirror circuit is set to 2 or more nA10nA. The precharge or the discharging circuit which emits or charges the electric charge of the source signal line 18 compulsorily is built in.
[0242]It is known that an organic EL device has the big temperature dependence characteristic (temperature dependenccy characteristics). In order to adjust the light-emitting-luminance change by these temperature dependenccy characteristics, nonlinear elements, such as a thermo sensitive register to which output current is changed, or posistor, are added to a current mirror circuit, and reference current is created in analog by adjusting change by temperature dependenccy characteristics with said thermo sensitive register.
[0243]In this case, since it is uniquely determined by the EL material to choose, it is not necessary to carry out soft control of the microcomputer 652 etc. in many cases. That is, it may fix to a fixed shift amount etc. with a liquid crystal material. It is important that temperature dependenccy characteristics change with luminescent color materials, and it is required ******** which performs optimal temperature-dependenccy-characteristics compensation for every luminescent color.
[0244]A microcomputer may perform temperature-dependenccy-characteristics compensation. The temperature of an EL display panel is measured with a temperature sensor, and it is made to change with the measured temperature with a microcomputer (not shown) etc. It may control to change reference current etc. automatically by microcomputer control etc. at the time of a change, and to be able to display a specific menu indication. It may constitute so that it can change by changing using a mouse etc., using the display screen of an EL display as a touch panel, and displaying a menu, and pressing down a specified part.
[0245]In this invention, a source driver is formed with a semiconductor silicon chip, and is connected with the terminal of the source signal line 18 of the substrate 46 with glass art on chip (COG). As for wiring of signal wires, such as the source signal line 18, metallic wiring, such as chromium, aluminum, and silver, is used. It is because wiring of low resistance is obtained with thin wiring width. Wiring is the material which constitutes the reflection film of a pixel, when a pixel is a reflection type, and forming simultaneously with a reflection film is preferred. It is because it can carry out simple [of the process].
[0246]This invention is good also as composition which does not limit to COG technology, loaded the above-mentioned driver IC 14 etc. into chip one film (COF) art, and was connected with the signal wire of the display panel. Drive IC produces power supply IC102 separately, and is good also as 3 chip configurations.
[0247]A TCF tape may be used. The film for TCF tapes can bond a polyimide film and copper (Cu) foil by thermo-compression, without using adhesives. In addition to this, there are a method which carries out cast molding of the polyimide which dissolved on Cu foil in piles, and a method which attaches Cu by plating or vacuum evaporation on the metal membrane which formed by sputtering on the polyimide film in the film for the TCP tapes which attach Cu to a polyimide film without using adhesives.
[0248]Although these any may be sufficient, the method of using the TCP tape which attaches Cu to a polyimide film without using adhesives is the most preferred. It corresponds to a lead pitch of 30 micrometers or less with Cu beam laminate sheet not using adhesives. Since the method of forming a Cu layer by plating or vacuum evaporation among Cu beam laminate sheets not using adhesives is suitable for slimming down of the Cu layer, it is advantageous to the minuteness making of a lead pitch.
[0249]On the other hand, the gate driver circuit 12 is formed with low-temperature-polysilicon art. That is, it forms in the same process as TFT of a pixel. This is because an internal structure is easy as compared with the source driver 14 and clock frequency is also low.
[0250]Therefore, even if it forms with low-temperature polysilicon art, it can form easily, and narrow picture frame-ization can be realized. Of course, it cannot be overemphasized that the gate driver 12 may be formed with a silicon chip, and it may mount on the substrate 46 using COG technology etc. The pixel TFT, a gate driver, etc. may be formed by elevated-temperature polysilicon technology, and may be formed with organic materials (organic TFT).
[0251]The gate driver 12 contains the shift register 22b the shift register 22a of **, and for the gate signal line 17a gate signal lines 17b. Each shift register 22 is controlled by the clock signal (CLKxP, CLKxN) of a non-inverter and a negative phase, and a start pulse (STx). In addition, it is preferred to add the enabling (ENABL) signal which controls the output of a gate signal line and a non output, and the up-and-down (UPDWM) signal which carries out the up-and-down inversion of the shift direction. It is preferred to provide the output terminal etc. which otherwise check that the start pulse is shifted and outputted to the shift register.
[0252]The shift timing of a shift register is controlled by the control signal from control IC (not shown). The level shift circuit which performs the level shift of external data is built in. An inspecting circuit is built in.
[0253]Since the buffer capacity of the shift register 22 is small, the gate signal line 17 cannot be driven directly. Therefore, between the output gates 24 which drive the output and the gate signal line 17 of the shift register 22, at least two or more inverter circuits 23 are formed.
[0254]it is also the same as when forming the source driver 14 directly on the substrate 46 with polysilicon art, such as low-temperature polysilicon, and two or more inverter circuits are formed between the gate of analog switches, such as a transfer gate which drives a source signal line, and the shift register of a source driver. The following matters (the output of a shift register and the output stage (matter about the inverter circuit arranged among output stages, such as an output gate or a

transfer gate) which drives a signal wire are matters common to a source drive and a gate drive circuit.)
[0255]For example, in drawing 2, illustrated as the output of the source driver 14 was directly connected to the source signal line 18, but. Actually, as for the output of the shift register of a source driver, a multi stage inverter circuit is connected and the output of the inverter is connected to the gate of analog switches, such as a transfer gate.
[0256]The inverter circuit 23 comprises a MOS transistor of P channel, and a MOS transistor of N channel. As explained also in advance, the inverter circuit 23 is connected to the outgoing end of the shift register circuit 22 of the gate driver circuit 12 in multistage, and the final output is connected to the output gate 24. The inverter circuit 23 may consist of only P channels. However, it may constitute not as an inverter but as a mere gate circuit in this case.
[0257]The channel width of TFT of P channel which constitutes each inverter circuit 23, or N channel W, Channel length is set to L (in on double-gate **, the width or channel length of a channel who constitutes is added), and the degree of the inverter near the 1 and display side is set to N (eye N stage) for the degree of the inverter near a cyst register.
[0258]Multiplex [of the characteristic difference of the inverter 23 connected if there are many connection number of stageses of the inverter circuit 23] (piled up) is carried out, and a difference arises from the shift register 22 in the transfer time to the output gate 24 (time delay variation). In the case of being extreme, to for example, that [one / the output gate 24a / in drawing 2 / (output voltage has changed) / that / 1.0microsec backward (measuring, after a pulse is outputted from a shift register)]. The state, one [the output gate 24b / 1.5microsec backward (measuring, after a pulse is outputted from a shift register)] (output voltage has changed), arises.
[0259]Therefore, although a direction with more than [little / inverter circuit / 23 / which is produced between the shift register 22 and the output gate 24] is good, gate width W of the channel of TFT which constitutes the output gate 24 is dramatically large. The gate driving ability of the output stage of the cyst register 22 is small. Therefore, it is impossible to drive the output gate 24 directly in the gate circuits (NAND circuit etc.) which constitute a shift register. Therefore, although it is necessary to carry out multi stage connection of the inverter, For example, if the ratio of the size of W4/L4 (channel length of the channel width / P channel of P channel) of the inverter 23d of drawing 2 to the size of W3/L3 of the inverter 23c is large, a time delay will become long and variation will also become [the characteristic of an inverter] large.
[0260]The relation between time delay variation (a dotted line shows) and a time delay ratio (a solid line shows) is shown in drawing 3. (Wn-1/Ln-1) / (Wn/Ln) shows a horizontal axis. For example, L of the inverter 23d and the inverter 23c is the same at drawing 2, and if it is 2W3=W4 (W3/L3), it is /(W4/L4) =0.5. In the graph of drawing 3, a time delay ratio sets the time of (Wn-1 / Ln-1) / (Wn/Ln)=0.5 to 1, and is setting time variation as well as delay to 1.
[0261]It is shown that the connection number of stages of the inverter 23 increases, and time delay variation becomes large, so that (Wn-1 / Ln-1) / (Wn/Ln) becomes large in drawing 3, It is shown that the time delay to the inverter 23 from the inverter 23 to the next step becomes long, so that (Wn-1/Ln-1) / (Wn/Ln) becomes small. It is advantageous on a design to make a time delay ratio and time delay variation into less than two from this graph. Therefore, what is necessary is just to satisfy the conditions of a following formula.
[0262]0.25 The W/L ratio (Wp/Lp) of <=(Wn-1/Ln-1)/(Wn/Ln) <=0.75 and P channel of each inverter 23 and the W/L ratio (Ws/Ls) of n channel need to satisfy the following relations.
[0263]
0.4 If the number of stages n of the inverter 23 formed between output gates (or transfer gate) from the outgoing end of a shift register at <=(Ws/Ls)/(Wp/Lp) <=0.8 pan satisfies a following formula, there is also little variation in a time delay and it is good.
[0264]3 The <= n <= 8 mobility mu has a technical problem. If mobility mun of n channel transistor is small, the size of TG and an inverter will become large and power consumption etc. will become large. The forming face product of a driver becomes large. Therefore, panel size will become large. On the other hand, if large, it will be easy to cause the characteristic degradation of a transistor. Therefore, mobility mun has the following good ranges.
[0265]50 Make the slew rate of the clock signal in <= mun <= 150 and the shift register 22 less than 500v/microsec. When a slew rate is high, degradation of n channel transistor is intense.
[0266]A NAND circuit may be sufficient although it presupposed at the output of the shift register that the inverter 23 is connected to multistage by drawing 2. It is because an inverter can be constituted also from a NAND circuit. That is, what is necessary is just to consider the connection number of stages of a gate with the connection number of stages of the inverter 23. Relations, such as a W/L ratio explained also in this case until now, are applied.
[0267]The cathode of EL element 15 is connected to Vs1 potential with the composition illustrated by drawing 1. However, there is a problem that the driver voltages of the organic electroluminescence which constitutes each color differ. For example, when the current of 0.01 (A) per unit square centimeter is sent, in blue (B), the terminal voltage of an EL element is 5(V), but in green (G) and red (R), they are 9(V)s. That is, terminal voltage differs by B, G, and R. Therefore, in B, G, and R, the sauce drain voltage (SD voltage) of 11c11 d of transistors to hold differs. Therefore, the sauce drain voltage (SD voltage) OFF leakage current of a transistor will differ in each color. If OFF leakage current occurs and OFF leakage characteristics differ in each color, it will become about the complicated displaying condition which a flicker generates after color balance has shifted that correlate with the luminescent color and the gamma characteristic shifts.
[0268]In order to cope with this technical problem, it constitutes from this invention so that it may illustrate to drawing 5, and the potential of one cathode terminal may be changed with the potential of the cathode terminal of other colors among R, G, and B color at least. By drawing 5, B is used as the cathode terminal 53a, and, specifically, G and R are used as the cathode terminal 53b.
[0269]The cathode terminal 53a is formed using the metal mask art which distinguished the organic electroluminescence of each color by different color with. A metal mask is used because organic electroluminescence cannot perform etching etc. in water weakly. Using a metal mask (not shown), the cathode terminal 53a is vapor-deposited and connection is taken simultaneously in the contact hole 52a. The B cathode wiring 51a and an electrical link can be taken by the contact hole 52a.
[0270]The cathode terminal 53b is similarly formed using the metal mask art which distinguished the organic electroluminescence of each color by different color with. Using a metal mask (not shown), the cathode terminal 53b is vapor-deposited and connection is taken simultaneously in the contact hole 52b. The RG cathode wiring 51b and an electrical link can be taken by the contact hole 52b. The aluminum film thickness of a cathode terminal is good to form so that it may be set to not

less than 70 nm 200 nm or less.
[0271]Since different voltage can be impressed to the cathode terminals 51a and 51b by the above composition, even if the Vdd voltage of drawing 1 is common to each color, the voltage impressed to EL of at least 1 color among RGB can be changed. At drawing 5, although it is considered as the same cathode terminal 53b, it may not limit to this, and it may constitute from RG so that it may become a cathode terminal which differs by R and G.
[0272]By constituting as mentioned above, in each color, the OFF leakage current between the sauce drain voltage (SD voltage) of a transistor can occur, and a kink phenomenon can be prevented. Therefore, a flicker does not have generating, it does not correlate with the luminescent color, the gamma characteristic does not necessarily shift, and good image display can be realized.
[0273]It cannot be overemphasized that Vs1 of drawing 1 may be made into cathode voltage, it may not limit to this although it presupposes that this cathode voltage is made to differ in each color, and the anode voltage Vdd may be constituted so that it may differ in each color. For example, it is the composition which makes Vdd of the pixel of R voltage 8(V), makes G 6(V)s and makes B 10(V)s. As for such anode voltage and cathode voltage, it is preferred to constitute so that it can adjust in the range of **1(V).
[0274]Even if panel size is about 2 inches, about 100-mA current is outputted from the anode connected with Vdd. Therefore, low-resistance-izing of the anode wiring 20 (current supply source line) is indispensable. In order to cope with this technical problem, by this invention, anode 63 wiring is supplied from viewing-area the upper part and the bottom so that it may illustrate by drawing 6 (both-ends electric supply). Generating of the luminosity inclination by the upper and lower sides of a screen is lost by carrying out both-ends electric supply as mentioned above.
[0275]In order to raise light emitting luminance, it is good to carry out surface roughening of the pixel 48. This composition is shown in drawing 7. First, the La Stampa art is used for the part which forms the picture element electrode 48, and detailed unevenness is formed in it. When a pixel is a reflection type, the metal thin film of about 200-nm aluminum is formed by sputtering process, and the picture element electrode 48 is formed. Surface roughening of the heights is provided and carried out to the part where the picture element electrode 48 touches organic electroluminescence. In the case of a simple matrix type display panel, the picture electrode 48 makes it the shape of a stripe like electrode. Heights may not be limited only to convex and a concave may be sufficient as them. Concave and a convex may be formed simultaneously.
[0276]The size of the projection was about 4 micrometers in diameter, set the average value of the distance between contiguity to 10 micrometers, 20 micrometers, and 40 micrometers, and performed the 120 measurement of luminance/mm for the unit area density of the projection from 1000 to 1200 pieces/square milimeter and 100 as 2 and 600 to 800 pieces/square milimeter, respectively. Then, it turned out that light emitting luminance becomes strong, so that the unit area density of the projection became large. Therefore, it turned out that the surface state of a picture element electrode is changed and light emitting luminance can be adjusted by changing the unit area density of the projection on the picture element electrode 48. According to examination, the result good in 800 or less pieces [100 or less //square milimeter]/square milimeter was able to be obtained for the unit area density of the projection.
[0277]Organic electroluminescence is a self-light emitting device. If the light by this luminescence enters into TFT as a switching element, a phot conductor phenomena (contest the phot) will occur. In contest a phot, the phenomenon whose leak (off-leak) in the time of OFF of switching elements, such as TFT, increases by optical pumping is said.
[0278]In order to cope with this technical problem, as shown in drawing 9, by this invention, the lower layer of the gate driver 12 (depending on the case, it is the source driver 14) and the lower layer light-shielding film 91 of the picture element transistor 11 are formed. The light-shielding film 91 is formed with metal thin films, such as chromium, and sets the thickness to not less than 50 nm 150 nm or less. If thick [when thickness is thin, shielding effects are scarce, and], unevenness will occur and patterning of TFT11A1 of the upper layer will become difficult.
[0279]The smoothing film 71a which consists of or more 20 an inorganic material of 100 nm or less is formed on the light-shielding film 91. One electrode of the storage capacitance 19 may be formed using the layer of this light-shielding film 91. In this case, as for the smooth film 71a, it is preferred to enlarge capacity value of structure storage capacitance thinly as much as possible. The light-shielding film 91 may be formed with aluminum, a silicon oxide film may be formed in the surface of the light-shielding film 91 using anodization art, and this silicon oxide film may be used as a dielectric film of the storage capacitance 19. The picture element electrode of HA structure is formed on the smoothing film 71b.
[0280]The driver circuit 12 should control not only a rear face but penetration of the light from the surface. It is because it malfunctions under the influence of contest a phot. Therefore, in this invention, when a cathode terminal is a metal membrane, a cathode terminal is formed also in the surfaces, such as the driver 12, and this electrode is used as a light-shielding film.
[0281]However, if a cathode terminal is formed on the driver 12, malfunction of the driver by the electric field from this cathode terminal or the electric interengagement of a cathode terminal and a driver circuit may occur. In order to cope with this technical problem, in this invention, at least one layer of organic electroluminescence films of two or more layers are preferably formed simultaneously with the organic electroluminescence film formation on a picture element electrode on the driver circuit 12 etc.
[0282]Fundamentally, since an organic electroluminescence film is an insulating material, between a cathode and a driver is isolated by forming an organic electroluminescence film on a driver. Therefore, the above-mentioned technical problem is cancelable.
[0283]On the other hand, when a cathode terminal is a transparent electrode, the sheet resistance values of a transparent electrode pose a problem. Although a transparent electrode is high resistance, it is necessary to send current through the cathode of organic electroluminescence with high current density. If it carries out and backlash forms a cathode terminal by the monolayer of an ITO film, it will be in a heated state by generation of heat, or the luminosity inclination of a degree occurs very much in a display screen.
[0284]In order to cope with this technical problem, the low resistance-ized wiring 92 which consists of a metal thin film on the surface of a cathode terminal is formed. The low resistance-ized wiring 92 is the same composition (it is thickness (50 nm - 200 nm) at chromium or the charge of an aluminum material) as the black matrix (BM) of a liquid crystal display panel, and it is the same position (between picture element electrodes, on the driver 12, etc.). However, in organic electroluminescence, since it is

not necessary to form BM, functions completely differ. The low resistance-ized wiring 92 may not be limited to the surface of the transparent electrode 72, and may be formed in a rear face (field which touches an organic electroluminescence film).
[0285]Drawing 10 is a lineblock diagram of an organic electroluminescence module. Control IC101 and power supply IC102 are mounted in the printed circuit board 103. The printed circuit board 103 and the array substrate 49 are electrically connected by the flexible substrate 104. Power supply voltage, current, a control signal, and picture image data are supplied to the source driver 14 and the gate driver 12 of the array substrate 49 via this flexible substrate 104.
[0286]Under the present circumstances, the control signal of the gate driver 12 poses a problem. It is necessary to impress the control signal of the amplitude of at least 5 or more (V) to the gate driver 12. However, since the power supply voltage of control IC101 is 2.5(V)s or 3.3(V)s, it cannot impress a control signal to the gate driver 12 directly from control IC101.
[0287]This invention impresses the control signal of the gate driver 12 to this technical problem from power supply IC102 driven on high voltage. Since power supply IC102 also generates the operating voltage of the gate driver 12, though natural, it can generate the control signal of the optimal amplitude for the gate driver 12.
[0288]In drawing 11, it is made to generate by control IC, and with the source driver 14, after the control signal of the gate driver 12 performs a level shift, it is once impressed to the gate driver 12. Since the driver voltage of the source driver 14 is 5 - 8(V), it can change the control signal of the 3.3(V) amplitude outputted from control IC101 into 5(V) amplitude which can receive the gate driver 12.
[0289]Drawing 14 and drawing 15 are the explanatory views of the display module device of this invention. Drawing 14 is the composition of having given built-in RAM151 in the source driver 14. Built-in RAM has the capacity of 8 color specification (1 bit of each color), 256 color specification (RG is a triplet and B is 2 bits), and 4096 color specification (RGB is 4 bits each). The driver controller with which it is these eight colors, 256 colors, or 4096 color specification, and has been arranged in the source driver 14 at the time of a still picture reads the image data of this built-in RAM151. Therefore, super-low power consumption is realizable. Of course, built-in RAM151 may be multicolor RAM of 260,000 or more colors. The image data of built-in RAM151 may be used also at the time of an animation.
[0290]The image data of built-in RAM151 may carry out the memory of the data after performing an error diffusion process or dithering. By performing an error diffusion process, dithering, etc., 260,000 color specification data can be changed into 4096 colors etc., and capacity of built-in RAM151 can be made small. The error diffusion controller 141 can perform error diffusion processes.
[0291]Although 14 was indicated to be a source driver in drawing 14 etc., Not only a mere driver but the power supply circuit 102, the buffer circuit 154 (circuits, such as a shift register, are included), The various functions or circuits which process the input from data conversion circuit, latch circuitry, command decoder, shift circuit, address conversion circuit, and built-in RAM151, and output voltage or current to a source signal line are constituted. This matter is the same in other examples of this invention.
[0292]A frame rate is related to the power consumption of a panel module. That is, if a frame rate is made high, power consumption will increase proportionally mostly. The cellular phone needs to aim at reduction of power consumption from viewpoints of lengthening standby time. On the other hand, in order to increase a foreground color (a gradation number is increased), drive frequencies, such as the source drivers IC 14, must be made high. However, it is difficult to increase power consumption from the problem of power consumption.
[0293]Generally, priority is given to low power consumption over display color numbers in information display devices, such as a cellular phone. Power consumption increases from the reasons of the clock frequency of the circuit to which display color numbers are made to increase becoming high, or change of a voltage (current) waveform impressed to an EL element increasing. Therefore, display color numbers can seldom be increased. To this technical problem, this invention performs an error diffusion process or dithering for image data, and displays a picture.
[0294]Although not illustrated in the cellular phone of this invention explained by drawing 19, the back side of the case is equipped with the CCD camera. A photograph is taken with a CCD camera and a picture can be displayed immediately at the display screen 21 of a display panel. The data photoed with the CCD camera can be displayed on the display screen 21. The image data of a CCD camera can change 24 bits (16,700,000 colors), 18 bits (260,000 colors), 16 bits (65,000 colors), 12 bits (4096 colors), and 8 bits (256 colors) by the keystroke 265.
[0295]When an indicative data is 12 bits or more, it displays by performing an error diffusion process. That is, when the image data from a CCD camera is more than the capacity of an internal memory, an error diffusion process etc. are carried out, and image processing is performed so that below the capacity of the internal memory 151 may become about display color numbers.
[0296]Now, it explains providing built-in RAM151 of one screen by 4096 colors (4 bits each of RGB) in the source drivers IC 14. When the image data sent from the module outside is 4096 colors, it is stored in built-in RAM151 of the direct source drivers IC 14, image data is read from this built-in RAM151, and a picture is displayed on the display screen 21.
[0297]When image data is 260,000 colors (G:6 bits, R, a total of 16 bits that is B:5 bits), As shown in drawing 14 and drawing 15, it is once stored in the operation memory 152 of the error diffusion controller 141, and error diffusion or dithering is performed in the arithmetic circuit 153 which performs error diffusion or dithering simultaneously. 16-bit image data is changed into 12 bits which is the number of bits of built-in RAM151 by this error diffusion process, and it is transmitted to the source drivers IC 14. The source drivers IC 14 outputs the image data of 4 bits each (4096 colors) of RGB, and displays a picture on the display screen 21.
[0298]In the composition of drawing 15, etc., an error diffusion process or a dither disposal method may be changed for every field or frame using Vertical Synchronizing signal VD (changing a disposal method with Vertical Synchronizing signal VD). For example, at dithering, it is using a Bayer type in the 1st frame, using a half-tone type at the following frame [2nd]. Thus, dithering is changed for every frame and the effect that the dot unevenness accompanying an error diffusion process etc. becomes difficult to be conspicuous is demonstrated by making it change.
[0299]Processing coefficients, such as an error diffusion process, may be changed by the 1st frame and the 2nd frame. An error diffusion process may be carried out by the 1st frame, dithering may be carried out by the 2nd frame, and processings, such as carrying out an error diffusion process by the 3rd [further] frame, may be combined. A random number generation circuit may be provided and the disposal method which processes for every frame with the value of a random number may be chosen.

[0300]If information, including a frame rate etc., is indicated to the format transmitted, a frame rate etc. can be automatically changed by decoding or detecting this indicated data. It is preferred that the picture transmitted especially indicates an animation or a still picture. As for an animation case, it is preferred to indicate the number of tops per second of an animation. It is preferred to indicate the machine type number of a cellular phone to a transmission packet. it is a packet although this specification explains as a transmission packet -- required -- there is nothing. That is, any may be sufficient as long as the information, including display color numbers, a frame rate, etc., explained by drawing 18 etc. into the data transmitted or sent is indicated.
[0301]Drawing 17 is a transmission format sent to the cellular phone of this invention, etc. With transmission, the both sides of the data to receive and the data to transmit are included. That is, it is because a cellular phone may transmit the picture photoed with the CCD camera of attachment in the sound or cellular phone from a receiver to other cellular phones. Therefore, the matter relevant to the transmission format etc. which are explained by drawing 18 etc. is applied to the both sides of transmission and reception.
[0302]In the cellular phone of this invention, data is digitized and is transmitted according to packet format. As drawing 16 and drawing 17 have indicated, the inside of a frame consists of flag part (F), address part (A), control section (C), and information bureau (I), frame check sequence (FCS), and a flag part (F). the format of a control section (C) -- a figure -- like -- information transfer (I frame) -- it is related (S frame) and three forms of an off duty item system (U frame) are taken.
[0303]First, information transfer format will be the form of the control field used when transmitting information (data), and if a part of non-number nature form is removed, information transfer format will be the only form of having a data field. The frame by this form is called data frame (I frame).
[0304]Supervisory format is a form used in order to perform the supervisor control function of a data link, i.e., the confirmation of receipt of a data frame, request sending of a data frame, etc. The frame by this form is called supervisory frame (S frame).
[0305]Next, it is the form of the control field used in order that off duty item system form may carry out other data ring control facilities, and the frame by this form is called unnumbered frame (U frame).
[0306]A terminal and a net manage the data frame transmitted and received by the send sequence number (S) and the receiving sequence N (R). N (S) and N (R) comprised a triplet, eight to 0-7 was used as a circulation number, and the next of 7 has taken the modulus composition from which it is set to 0. Therefore, the modulus in this case is 8 and the frame number which can carry out continuous transmission without receiving a response frame is 7.
[0307]The 8-bit data in which the 8-bit data in which color number data is shown, and a frame rate are shown is indicated in a data area. These examples are shown in drawing 18 (a) and (b). It is preferred to indicate distinction of a still picture and an animation to the color number of a foreground color. It is desirable to indicate the kind name of a cellular phone, the contents (natural drawings, such as a person, menu screen) of the image data transmitted and received, etc. to the packet of drawing 17.
[0308]The model which received data decodes data, and when it is own (applicable machine type number) data, it changes a foreground color, a frame rate, etc. automatically according to the indicated contents. It may constitute so that the indicated contents may be displayed on the viewing area 21 of a display. A user operates a key etc., seeing the description content (a foreground color, a recommendation frame rate) of Screen 21, and changes into the optimal displaying condition by a manual.
[0309]As an example, by drawing 18 (b), although numerical 3 has given and indicated frame rate 80Hz and an example, it may not be limited to this, and it may show fixed ranges, such as 40 to 60 Hz. The model of cellular phone, etc. may be indicated to a data area. It is because the necessity of performances etc. differing depending on the model and changing a frame rate is also generated. Pictures are comics, it is advertisement (CM), or it is also preferred to indicate thing information. The information on audience fee gold etc. is indicated to a packet. Information, including packet length etc., may be indicated. A user judges whether audience fee gold checks and information is received. It is preferred to also indicate the data of whether image data is carried out in the error diffusion process.
[0310]What is necessary is just to indicate information, including an image processing method, machine type numbers (the kind of classification, such as an error diffusion process and dithering, and weighting function, the data, the coefficient of gamma, etc.), etc., to the format transmitted. Image data indicates the information on the resolution, MPEG data, BITMAP data, etc. again in the data photoed by CCD, and JPEG data. by decoding or detecting this indicated data, it can change into the optimal state with the cellular phone etc. which were received automatically -- it becomes be.
[0311]Of course, it is preferred that the picture transmitted indicates an animation or a still picture. In the case of an animation, it is preferred to indicate the number of tops per second of an animation. It is preferred to also indicate information, including the number of reproduction tops / second recommended with a receiving terminal.
[0312]The above matter is the same even when a transmission packet is transmission. it is a packet although this specification explains as a transmission packet -- required -- there is nothing. That is, any may be sufficient as long as the information explained by drawing 18 etc. into the data transmitted or sent is indicated.
[0313]After the error diffusion process controller 141 performs a reverse error diffusion process and returns the data which error processing was carried out and has been sent to source data, it is preferred to add again the function to perform an error diffusion process. The existence of the error diffusion process is put on the packet data of drawing 17. Data required for reverse error diffusion processes, such as a disposal method of error diffusion (methods, such as a dither, are also included) and form, is also carried.
[0314]A reverse error diffusion process is carried out because the error diffusion process can also realize amendment of a gamma curve in the process of the processing. Gamma curves, such as an EL display which received data, and the sent gamma curve may not be adapted. The data which has acted as transmitting parents may be image data by which processing of error diffusion etc. was already carried out.
[0315]In order to cope with this situation, a reverse error diffusion process is carried out, and it changes into source data, and is made for there to be no influence of gamma curve amendment. Then, the EL display etc. which were received perform an error diffusion process, and an error diffusion process etc. are carried out so that it may become the optimal gamma curve for a receiving display panel and may become the optimal error diffusion process.
[0316]What is necessary is to arrange with a user button to devices, such as a cellular phone, and just to change a foreground color etc. using a button etc. to change a frame rate by a foreground color.

[0317]Drawing 19 is a top view of the cellular phone as one example of information terminal equipment. The antenna 191, the ten key 192, etc. are attached to the case 193. 194 etc. is a foreground-color exchange key or power supply turning on and off, and a frame rate exchange key.
[0318]Internal circuit blocks, such as a cellular phone, are shown in drawing 20. A circuit mainly comprises a block of the up converter 205 and the down converter 204, and a block of the block LO buffer 203 of the duplexer 201, etc.
[0319]If the key 194 is pressed down once, a foreground color will press down the same key 194 following 8 color modes and a foreground color will press down the key 194 further 256 color modes, a foreground color may also construct a sequence so that it may become 4096 color modes. Whenever it presses down a key, let it be a toggle switch from which foreground-color mode changes. The change key to a foreground color may be provided separately. In this case, the key 194 is set to three (above).
[0320]Other mechanical switches, such as a slide switch besides a push switch, may be sufficient as the key 194, and it may switch by speech recognition etc. For example, by carrying out voice input of the 4096 colors to carrying out voice input to a receiver, for example, "a high-definition display", "256 color modes" or "low foreground-color mode", and a receiver, it constitutes so that the foreground color displayed on the display screen 21 of a display panel may change. This is easily realizable by adopting the present speech recognition technology.
[0321]The switch which switches electrically may be used for the change of a foreground color, and the touch panel chosen by touching the menu displayed on the indicator 21 of a display panel may be sufficient as it. It may constitute so that it may switch or switch by rotation or a direction like a click ball by the number of times which presses down a switch.
[0322]Although 194 considered it as the foreground-color exchange key, it is good also as a key etc. which switch a frame rate. It is good also as a key etc. which switch an animation and a still picture. Two or more requirements, such as a frame rate, may be simultaneously changed to an animation and a still picture. If it continues pressing down, it may constitute so that a frame rate may change gradually (continuously). In this case, it is realizable by making resistance R into a variable resistor, or making it into electronic volume among the capacitor C which constitutes an oscillator, and the resistance R.
[0323]A capacitor is realizable by considering it as a trimmer capacitor. Two or more capacitors are formed in the semiconductor chip, one or more capacitors may be chosen, and these may be realized by connecting in parallel in circuit.
[0324]The technical idea of switching a frame rate by a foreground color etc. is not limited to a cellular phone, and can be widely applied to the apparatus which has display screens, such as a palmtop computer, a notebook computer, a disk top personal computer, watch. It is applicable also to not the thing limited to a liquid crystal display (liquid crystal display panel) but a liquid crystal display panel, an organic EL panel, a TFT panel and the PLZT panel, and CRT.
[0325]The technical idea explained in the example of this invention is applicable to a video camera, a liquid crystal projector, stereoscopic television, projection TV, etc. It is applicable also to a viewfinder, the monitor of a cellular phone, PDA, PHS, a Personal Digital Assistant and its monitor, a digital camera, and its monitor. It is applicable also to an electrophotography system, a head mount display, an accepting-reality monitor display, a note personal computer, a video camera, and an electronic "still" camera.
[0326]It is applicable also to the monitor of a cash automatic drawer machine, a public telephone, a TV phone, a personal computer, a liquid crystal wrist watch, and its display. It cannot be overemphasized to the liquid-crystal-display monitor of homeuse-electronics apparatus, a pocket game machine machine and its monitor, the back light for display panels, etc. that application or application deployment can be carried out.
[0327]
[Effect of the Invention]As mentioned above, since the produced inspection or evaluation of an array substrate or a display panel is easily realizable by this invention, a reliable display can be provided.
[0328]The display panel of this invention, a display, etc. demonstrate a characteristic effect according to each composition of high definition, low power consumption, low-cost-izing, a rise in luminosity, etc.
[0329]Since the information display device of low power consumption, etc. can be constituted if this invention is used, electric power is not consumed. Since a small weight saving can be carried out, resources are not consumed. Therefore, he will be kind to earth environment and the space environment.

[Translation done.]